

No. 8. — *Catalogue of the Mammals of Massachusetts : with a Critical Revision of the Species.* By J. A. ALLEN.

THE original design of the present catalogue was simply to contribute a few data concerning the distribution of the Mammals of New England ; but in order to explain certain views entertained by the writer in respect to the character of a number of currently received species, many critical notes were gradually incorporated, until finally it was thought best to extend the paper so as also to embrace a systematic revision of the species. The catalogue is based mainly on observations made by myself at Springfield. In its faunal characteristics this locality does not differ much from those parts of the State lying east of the Connecticut River generally. A few species which occur only in the western mountainous portions have been included on data afforded chiefly by the official report on the Mammals of the State by the late Dr. Ebenezer Emmons, but in part as the result of observations and inquiries of my own recently made in that section. Respecting the marine species, I have consulted Captain N. E. Atwood, of Provincetown, a gentleman well known as a reliable observer, and whose forty years' experience along our coast has rendered him very familiar with our larger marine Vertebrata. I have thus been able to add not a little to our knowledge of some of those species least known, and the most difficult to observe, of all our Mammalia. The great obligation I am under for his kind co-operation is fully evident from the valuable notes he has furnished on the Cetaceans. I am also greatly indebted to Professor E. D. Cope, of Philadelphia, to whom I transmitted the notes of Captain Atwood, for kindly identifying the species.

Less attention seems to have been paid by our naturalists to the Mammals of the State than to the Birds, or several of the other classes of our animals. This may be owing to the greater difficulty of observing and procuring the former, arising from either their scarcity or reclusive habits.

The first general scientific notice of Massachusetts Mammalia seems to have been a simply nominal catalogue by Dr. Edward Hitchcock, published in his Report on the Geology, Mineralogy, Botany, and

Zoölogy of the State (pp. 526, 527), in 1833. Forty-five species are there given, including the two Seals and three Cetaceans. To a few only are notes added respecting their relative abundance. Dr. Emmons's first Report, under the Act of the Legislature of 1837 for a Natural History Survey of the State, was published in 1838. In 1840 a second and final Report\* was presented, containing the substance of the first, and considerably increased by additions. These Reports contain descriptions of all the land Mammalia then known to inhabit the State, with interesting notes on their habits and distribution, but nothing on the marine. The whole number of species given is forty-four, two of which (*Arvicola hirsuta* = *A. riparia*, and *A. albo-rufescens* = *A. riparia*, albino) were erroneously described as new. Eliminating three that have since been reduced to synonymes (*Condylura macroura*, *Sciurus niger*, *Arvicola albo-rufescens*) leaves forty-one as the number of valid species embraced in this report. The animal now known as *Hesperomys leucopus* Baird was described as *Arvicola Emmonsii* De Kay. On the whole, however, the work is remarkable for its accuracy, and, compared with those of most recent writers, for the small number of merely nominal species it contains.

The only other special treatise on our Mammals is an article by Mr. E. A. Samuels, in the Ninth Annual Report of the State Board of Agriculture,† in which thirty-nine species are described, excluding two merely nominal (a *Blarina* and *Arvicola rufidorsum*), mainly from Massachusetts specimens in the State Cabinet of Natural History; it also contains notes on their habits, and several woodcuts of the animals. Though not assuming to give all the species of the State, Mr. Samuels includes five or six described since the publication of Dr. Emmons's Report, but omits several of that author that are not uncommon in certain sections of the State, as well as all the marine species. In Audubon and Bachman's "Viviparous Quadrupeds of North America" (three volumes, 8vo, 1846-1853) are numerous references to Massachusetts Mammals specimens of which were frequently furnished these authors by our well-known ornithologist, Dr. T. M. Brewer, of Boston. But since the publication of Dr. Emmons's Report, no one, excepting perhaps Dr. Brewer and

\* Report on the Quadrupeds of Massachusetts. By EBENEZER EMMONS, M.D. 1840. 8vo. pp. 86. This is the edition cited in the following pages.

† Agr. of Mass., 1861, pp. 137-191.

Mr. Samuels, has done more to increase our knowledge of their history than Mr. J. W. P. Jenks, of Middleboro'. From this locality Mr. Jenks has sent large collections of the smaller species to the Smithsonian Institution, which have been carefully worked up by Professor S. F. Baird in his invaluable Report on the Mammals of North America,\* and by Dr. H. Allen in his recent excellent Monograph of the North American Bats.† In the Journal and Proceedings of the Boston Society of Natural History, among the very few notices of our Mammals, is an important paper by the Rev. John Bachman on the Mole Shrews (genus *Scalops*),‡ in which a new species (*S. Breweri*) is described from specimens from this State contributed by Dr. Brewer. In Professor Baird's Report on North American Mammals two species of *Arvicola* (*A. Breweri* and *A. rufidorsum*) are also described as new, solely from specimens from Massachusetts; the first was collected by Dr. Brewer on Muskeget Island. (On these see remarks beyond.) In February, 1863, Professor A. E. Verrill mentions, in a valuable contribution on the Shrews of New England,§ the first known occurrence of a *Neosorex* (*N. palustris*) in this State.

The more important publications on the Mammals of adjoining States, which in this connection demand a passing notice, are the Rev. J. H. Linsley's "Catalogue of the Mammalia of Connecticut,"|| Dr. J. E. De Kay's well-known Report on the Mammals of New York, and Professor Zadoc Thompson's notes on those of Vermont.¶ Mr. Linsley's list numbers seventy-one species, embracing the marine and domesticated, and nine that are merely nominal. Removing the latter, the eight domestic, and two ("*Arvicola floridanus* Ord" and "*Phoca grænlantica* ? Mull.") of doubtful reference, leaves fifty-two as the number of valid indigenous and naturalized species (the latter being the three species of *Mus*), ten of which are marine and the remaining forty terrestrial. Two bats (*Vespertilio subulatus* Say and *Scotophilus noctivagans* = *V. noctivagans* Cooper) and one shrew (*Sorex platyrhinus*) are given in

\* Pacific Railroad Reports of Expl. and Surv., VIII, 1857.

† Monograph of the Bats of North America. By H. ALLEN, M. D. Smithsonian Miscellaneous Collections, June, 1864.

‡ Proc., Vol. I, p. 40, 1841; Journ., Vol. IV, p. 46, 1842.

§ Proc. Bost. Soc. N. II., Vol. IX, 164.

|| Am. Journ. of Science and Arts, XLIII (Oct. 1842), pp. 345-354.

¶ History of Vermont, Natural, Civil, and Statistical, etc. By ZADOC THOMPSON. 8vo. Burlington, 1842, and Appendix, 1853.

addition to the land animals described in Professor Emmons's Massachusetts report, while two of Emmons's *Cervida* and the Wolverine are very properly omitted.

Dr. De Kay's Report, which appeared but a few months later than Linsley's Catalogue, gives seventy-eight species as either actual or former inhabitants of the State of New York, including, in addition to the domestic and marine species of Linsley's list, five fossil species. No new ones are added, though several are described as such, and several previously well known are separated from their supposed distinct European allies and receive new names. Two species given by Linsley for Connecticut ("*Arvicola floridanus* Ord" and "*Phoca grænlandica*? Mull.") are rightly omitted, and others, including the Opossum (*Didelphys virginiana*), added. This is a southern species which has not yet, so far as I can learn, been detected east of the Hudson. Deducting the nominal species and those of doubtful reference, nine in number, and the eight domestic and five fossil, leaves fifty-six as the number of living valid ones, forty-six being land and ten marine. This is an excess of four only, — two bats and two very small species of shrew, — excluding the marine and the extra-limital *Didelphys virginiana*, over the number given by Dr. Emmons for Massachusetts.

Professor Thompson's Natural History of Vermont, published at about the same time, contains forty-three valid species, with descriptions of them drawn up mainly from Vermont specimens, and short general accounts of their habits. It embraces but one or two species not given in Dr. Emmons's report, one of which is the common Seal (*Phoca vitulina*). A single specimen of this is reported to have been captured on the ice in Lake Champlain, and in the Appendix, published in 1853, another similar instance is recorded.

The present catalogue embraces sixty-five species, giving for the first time a probably nearly complete list of the marine, the Seals and Cetaceans. The latter are now supposed to number eighteen species. Four land species (*Scotophilus georgianus*, *Scalops Breweri*, *Neosorex palustris*, and *Arvicola pinetorum*) are also added, that are not mentioned by either Dr. Emmons or Mr. Samuels, or by either of the extra-limital authors mentioned above.

In Massachusetts, as far as Mammals and Birds are concerned, portions of two Faunæ are represented, — the Canadian and the Alleghanian ;



the former occupying a large part of Berkshire and most of the western half of Franklin, Hampshire, and Hampden Counties, or those portions of the State having an elevation of and above fifteen hundred feet above the sea ; the latter the remaining and by far the larger portion.\*

The recent or historic changes that have occurred in the Mammalian Fauna of the State consist mainly in the decrease in numbers of the larger species, amounting to a complete extirpation of a few of the large Carnivora and Cervidæ (*Felis concolor*, *Mustela Pennanti*, *Cervus canadensis*, *Alce malchis*, *Turandus rangifer*), and the great reduction, almost to extinction, of several others (*Lynx canadensis*, *Lynx rufus*, *Canis lupus*, *Ursus arctos*, *Cervus virginianus*). None of these species are now anywhere common, though there is good reason to believe that several of them were once so, while a few are known to have been of very frequent occurrence. The smaller species, including most of the rodents, the bats, moles, and shrews, seem to be fully as numerous as they ever were, while it is not improbable that a few, especially the *Arvicolæ* and other field mice, and perhaps the woodchuck (*Arctomys monax*), are even increasing in numbers. The three species of exotic or eastern origin are the now almost cosmopolitan *Mus decumanus*, *M. rattus*, and *M. musculus*, which long since became annoying pests, and constitute the only additions to our feral Mammalia that have become fully naturalized.

Several of the species of this list are considered to be identical with species of the Old World, although most late writers have separated as specifically distinct all but one of our New England Mammals — the *Gulo luscus* — from their Old World relatives. Only two or three species of land Mammalia are now generally considered as common to any portions of both the Eastern and Western hemispheres.† Several

\* The Canadian fauna, as represented in Massachusetts, may be characterized by the present or former occurrence among Mammalia of the following species: *Mustela Pennanti*, *M. martes*, *Gulo luscus*, *Alce malchis*, *Turandus rangifer*, *Cervus canadensis*, *Arvicola Gapperi*, and *Erethizon dorsata*. The Alleghanian may be distinguished by the absence of the preceding and the presence of *Vulpes virginianus*, *Scalops aquaticus*, *S. Breweri*, *Sciurus cinereus*, *Arvicola pinetorum*, and *Lepus sylvaticus*, which do not occur in the Canadian fauna.

† The same is also true of the land birds, while a large proportion of those marine species that are probably really common to both sides of the Atlantic are regarded as distinct. It should be observed, however, that the separations in both classes have been made mainly by the same persons. On the other hand, the highest authorities in entomology admit many species to be common throughout the northern hemisphere, par-

others, particularly of the genera *Arvicola* and *Blarina*, currently received as valid, are here treated as merely nominal. While our reasons therefor are given somewhat fully in their proper connection, a few general remarks in further explanation seem called for here.

In the present greatly increased state of our knowledge of American mammals, not a few characters once very naturally considered of great importance in a specific diagnosis are to be regarded as far from decisive, they now being known to be dependent either upon age, season, or locality, or to be mere individual variations. A difference in size, for instance, is at present well known in mammals, as well as in birds, to almost universally accompany differences in the latitude and elevation of their respective habitats, the southern representatives of species widely diffused being very appreciably smaller than the northern. The difference between the extremes amounts not infrequently to nearly one fourth, and occasionally even to one third, of the average size, so that, considered apart from the connecting stages afforded by representatives from the intervening districts, they might well be regarded as belonging to distinct species. It is also now well known that mammals vary geographically in respect to color, though not yet fully to what extent, and also in the character of the pelage. These latter facts have been long recognized practically in respect to the fur-bearing species, but it appears equally true of most of the others. Experienced trappers and fur-dealers readily distinguish the Mink and Sable skins of the north from those of the south, by the comparatively greater fineness, density, and length of the fur of the northern animal; \* similar differences are equally evident in the pelage of the Wolves, Foxes, Lynxes, and Hares. This difference is similar to that observable between winter and summer specimens from the same locality, the northern corresponding in the character of the pelage to the winter and the southern to the summer ones. The resemblance is perhaps still more striking in regard to the ticularly among the Hymenoptera, Neuroptera, and Coleoptera, and not a few are regarded as primitively almost cosmopolitan. The same is true in regard to plants, quite a large proportion of the species of the northern North American flora being considered identical with European and Asiatic. Hence we naturally inquire, Is there really this discrepancy in the distribution of species in the different classes of organized beings, or is it only apparent through the biased opinions of one or the other of these schools of observers?

\* In the case of the Minks, those of the prairies are distinguished as readily from those inhabiting the adjoining wooded districts, the former having coarser and browner fur, the difference being sufficient to materially affect their price in the market.

clothing of the feet, species with the soles thickly furred in winter often having them sparsely so in summer, northern individuals differing in like manner from southern. The variation in this respect increases with the distance in latitude between the localities whence the specimens compared are taken.

Besides these geographical or climatic variations, we have found by a careful comparison of scores of specimens of the *same species*, collected at the *same locality*, that there is a much greater range of variation between individuals of the same species—the variation extending to every part—than is commonly conceded; and also that differences depending upon season,\* as in the color, thickness, length, and general texture of the pelage, and others depending upon age\* and sex, instead of being always recognized by authors as such, have not unfrequently been taken to indicate a constant specific diversity. From this cause there has arisen, in numerous instances, an undue increase of so-called species. *Specimens* have too often been described instead of *species*. It is not surprising that these mistakes should have happened in the earlier days of our science, when the material for study was scanty and diagnoses were commonly drawn up from stuffed skins, the authors being in total ignorance of the appearance of the animal in life; when the extent of individual variation had not been especially investigated, and it was unknown that in animals possessing a wide distribution there were marked variations accompanying wide differences in locality. But even now

\* In spring, as is generally well known, mammals shed the long, thick coat worn in winter; this is replaced by a much shorter, thinner, less soft, and generally differently colored pelage. In this there is a gradual change throughout the summer, and late in fall it becomes either entirely replaced or effectually concealed by the growth of the long winter coat. The winter differs from the summer pelage not only in being longer and thicker, but generally in the different character of the hair composing it, and in the fulness of the soft under fur, as well as more or less in color. The shortness of the summer coat renders the ears of such animals as have these members very short, as the different species of *Arvicola*, *Sorex*, *Sciurus*, &c., much more conspicuous at that season than in winter, when in some of them they are nearly concealed. In young animals, too, the first pelage differs much from the succeeding, being shorter, darker, and generally more or less crisp. The general health of the animal, as no one need be told who has attentively observed domestic animals, has a marked effect upon the character of the coat, and on the time it is changed, as does also scantiness or abundance of food.

As previously stated in the text, species with the soles of the feet furred have them less densely so in summer than in winter. It is perhaps needless to advert to the fact of the existence of a temporary set of teeth in young animals, which gradually give place to a permanent one differing from the first in number and character.

but few mammalogists have come to recognize these variations as manifestations of general laws, and we are consequently scarcely surprised at the glaring inconsistencies into which even our best authorities are frequently betrayed, they at times assigning to these several variations their true character, and again, in apparently equally clear cases, considering them as indications of specific diversity. It thus happens that species are still not unfrequently based solely on differences that are but individual peculiarities, from these differences being first detected in comparing specimens from widely separated districts, whereas they are not different from variations presented by occasional specimens of the same species at any given locality. Oftener still, perhaps, species are founded on slight geographical variations, either solely or in connection with exceptional individual peculiarities, or on differences depending upon age. A remarkable instance of this latter kind seems to have occurred in our *Sorecidae*, and especially in *Blarina*, where no less than eight at present currently received species are apparently based on one. Imperfectly understood sexual variations, associated with other differences, in some cases render the complication still greater. This occurs in the *Mustelidae*, where the female is found to be very much smaller than the male in almost or quite all species when the sexual differences are well known. In the weasels the large amount of this difference seems to have thus far generally escaped notice, especially by American writers. As wide a range of variation, aside from the sexual, obtains in these as in their near allies, the mink and the marten. In this group, differences in size and in the relative length of the tail as compared with the body—the latter an extremely variable element—have been taken as important specific distinctions, and on these grounds alone some five species (so called) appear to have been based on two.

In respect to the differences that have been claimed to separate specifically the Old and the New World representatives of those species we in this paper consider identical, only those of very slight importance have as yet been adduced; they are only such as might be anticipated to occur when, as has repeatedly happened, the comparisons have been made between only a few specimens known to have been collected at localities widely differing in latitude, and hence in climatic conditions, and at different seasons of the year. More frequently, however, the exact origin and history of the specimens compared appears to have been wholly unknown. In no case are the differences greater, but

generally less, than those presented by specimens from different localities on the same continent, where the species is admitted to be the same; sometimes not greater than is seen at the same locality. From similar unsatisfactory comparisons, and undoubtedly in part from theories of distribution, representatives from distant points in the United States of species ranging from the Atlantic to the Pacific have been described as distinct species. Not till large series of specimens from hundreds of localities have been carefully compared can all these disputed points be properly settled, through the tolerably exact determination of the influence of "locality on the individual"; and we believe that no work more important than this can at present be done.

In this connection I can hardly avoid a word or two in reference to the spirit which evidently incites many zoölogists in their researches. I refer, of course, to that eagerness for describing "new species" so patent in all their publications,—an influence highly derogatory to the advancement of scientific knowledge. It tends to divert attention from such a critical study of those species living in the naturalist's immediate vicinity as will alone acquaint him with the amount of variation a species may be expected to present.\* Only by such a preparation can one be prepared to estimate properly the character and value of differences presented by specimens from remote districts, of which only a limited number of prepared examples can be examined. Almost all writers on the different classes of Vertebrata have fallen in a greater or less degree into the fault of describing species as new from either improper or insufficient material, or of founding them on characters that a critical study of numerous fresh specimens of a few well-known species would have shown were of very slight, and often of even no value as specific distinctions. The inquiry with many naturalists respecting doubtful specimens seems rarely to be whether they may not be referred to some already known species, and the points of resemblance to their nearest known ally accordingly carefully weighed against the differences, but rather are not they sufficiently different to warrant a description of them as new species? This greediness for *species nova* renders it

\* In respect to Birds, I have already called attention (Memoirs Bos. Soc. Nat. Hist., Vol. I, p. 512) to the importance of collecting and comparing a very large number of specimens from the same locality, to learn the extent of the variation a species may present at the same point: it is no less essential in Mammals, where seasonal variations and those depending upon age are not always so evident.



difficult to eradicate from our systems those even but doubtfully admitted when once they have been proposed by authors high in authority, such species being ultimately accepted without having ever been scientifically established. Authors afflicted with this mania rarely reject any species of their contemporaries, but they virtually indorse the doubtful ones by adding others of their own based on similar characters. The great proportion of merely nominal species hence annually added to our lists is a detriment to science deeply to be regretted.

Perhaps the strictures contained in this article will by some be deemed too severe; they are nevertheless made, not only reluctantly and in all cases without the slightest personal feelings, but from a conviction of their necessity, and with the sole object of advancing the truth. Gladly would I have left to others the unpleasant task.

While much of the material forming the basis of this list has been, as previously stated, that of my own collecting at Springfield, I am deeply indebted to the Museum of Comparative Zoölogy for additional data, and especially for a large amount of invaluable material for the revision of the species.\* It has also afforded me the opportunity of comparing American with European specimens of the species of *Mustelidæ* and *Canidæ*, and of examining specimens of most of the Mammals of North America. The very complete collection of Massachusetts mammals in the Springfield Museum of Natural History, mainly collected and prepared by Mr. C. W. Bennett, embracing as it does several unique specimens, has likewise been freely consulted, and with much profit. I have already referred to my indebtedness to Captain N. E. Atwood, of Provincetown, for notes on the Cetacea, and to Professor E. D. Cope for the identification of the species.

The names used in Dr. Emmons's Report are generally added as synonyms when different from those now adopted. A tabular comparison of the species given by Dr. Emmons from this State, by Dr. De Kay from New York, and by Mr. J. P. Linsley from Connecticut is made with those of the present list, in order to indicate their synonymy. In general only such synonyms are given, always from original examination, as are necessary to render clear the views of the writer on the

\* Probably no other Natural History Museum in the world affords facilities for the investigation of the individual variation of species equal to those presented by the immense collections of New England, and especially Massachusetts, Vertebrata contained in this Institution, brought together by the Director in great part for this especial purpose.

points in question. The thorough and exhaustive manner in which this part of the subject has already been treated by Professor Baird and Dr. Allen has rendered anything further than this unnecessary.

### FELIDÆ.

1. **Lynx canadensis** RAF. CANADA LYNX. Rare, and generally occurring only in the more thinly settled and mountainous parts of the State. A very large one was killed in November, 1866, in the town of Ware. Reports of their capture in the towns of western Hampden, Hampshire, and Franklin Counties, as well as in Berkshire, are not very infrequent.

2. **Lynx rufus** RAF. BAY LYNX. Apparently rather more common than the preceding species, but, like this, it is generally confined to the more wooded and mountainous districts. One was taken at Ipswich a short time since, and they seem to occur at intervals in all sections of the State.

The *Felis concolor* Linn. (Panther) has probably been for some time extinct in Massachusetts, though undoubtedly once occurring here. There is a stuffed specimen in Springfield said to have been killed a year or two since in the Adirondack Mountains of New York. A few months since the writer saw another that was captured on Pine Hill, in Weathersfield, Vermont, January 31, 1867. This specimen is said to have measured seven feet from the tip of the nose to the tip of the tail, to have stood two feet nine inches high, and to have weighed one hundred twenty-two and a half pounds. It had lived for some time previously on Asecutney Mountain, a few miles from where it was captured. Very good photographs of this rare animal, taken from this specimen before it was skinned, can be obtained of Mr. J. D. Powers, of Springfield, Vermont.

Professor Thompson states, in his Natural History of Vermont (p. 37), that for some time after the settlement of that State had commenced the Panther was so common there as to be considered dangerous to travellers unless they were well armed. In his Appendix (p. 12) he states that the last one he had known to be killed in that State, and also the only one for many years, was captured in Bennington, in February, 1850.

## CANIDÆ.

3. **Canis lupus** LINN. (*C. occidentalis* var. *griseo-albus* Baird.)  
 GRAY WOLF. Occasional in the sparsely populated districts of the western counties. Like the species of *Felida*, it has been nearly extirpated.

Authorities have differed greatly in their views respecting the identity of the American and European wolves; some, forming the majority, and among them apparently those whose opportunities for judging have been most favorable, have considered them the same, while others, and among them many who seem to have but casually examined the subject, have regarded them as distinct. Not only so, but — omitting certain varieties based on color and commonly received as merely nominal, though repeatedly raised to the rank of species — specimens from the middle and western portions of the continent have been described as specifically distinct, both from the Old World wolves and those of the eastern side of the continent.\* Dr. Richardson, than whom probably no one has had better opportunities for studying American wolves, after pointing out some trivial differences in physiognomy and in the character of the pelage between the wolves of Arctic America and the Pyrenees, observes: "Notwithstanding the above enumeration of the peculiarities of the American wolf, I do not mean to assert that the differences existing between it and its European congener are sufficiently permanent to constitute them, in the eye of the naturalist, distinct species. The same kind of differences may be traced between the foxes and native races of the domestic dog of the New World and those of the Old; the former possessing finer, denser, and longer fur, and broader feet, well calculated for running on the snow.† These remarks have been elicited by a comparison of live specimens of American and Pyrenean wolves; but I have not had an opportunity of ascertaining whether the Lapland and Siberian wolves, inhabiting a similar climate with the American ones, have similar peculiarities of form, or whether they differ in physiognomy from the wolf of the south of Europe." For this reason he considered it "unadvisable to designate the northern wolf of America by a distinct specific appellation"; "the word *occidentalis*" (*Canis lupus occidentalis*), he further observes, "which I have affixed to the Linnean name of *Canis lupus*, is to be considered as merely marking the geographical position of the peculiar race of wolf which forms the subject of this article."

Audubon and Bachman, the former having been long familiar with the American wolf in all its different varieties, unhesitatingly pronounced, after

\* As *C. mabilus* Say, *C. variabilis* Maximilian, *C. gigas* Townsend, &c.

† The comparisons in this case, it should be remembered, are between specimens from localities possessing widely differing climates.

careful and extended comparisons of specimens from the two continents, the common wolves of the Old World and the New to be, in their opinion, identical. But Dr. De Kay, giving but two lines to a consideration of the subject, very summarily separates the American wolf from its Old World congener under the name of *Lupus occidentalis*. Professor Baird, after admitting the weight of authority to be in favor of the supposition of their specific identity, considers them distinct, and adopts the name of "*Canis occidentalis*" for the American species. In referring to the different varieties of the North American wolf this author says: "For the present I prefer to consider all as one species, and to assume this with good reason as distinct from some at least of the European wolves, if that continent possesses more than one." Although previously admitting the unsatisfactory character of his materials,\* such a conclusion is but in accordance with his usual apparent predilection for considering American animals as distinct from their intimate affines of the Eastern continent, sometimes even where the weight of authority is by far in favor of their identity, and his own materials for an original examination of the subject are either entirely wanting or too scanty to be of much account.†

In his article on the Wolf (p. 108) Baird gives us, however, a most interesting and very valuable table of measurements of twenty-six skulls, chiefly from the Platte River, but which includes others from Sweden and Russia, as well as such remote points in North America as New York, Oregon, Texas, and Mexico. Aside from the markedly smaller size of those from the southern localities, the specimens do not appear to differ more than the same number might from either of the localities mentioned. The table shows variations in the proportion of breadth to length in the muzzle and in the whole skull, and in its relative breadth at similar points; but a careful examination of all the measurements given shows that these differences are inconstant, specimens from near the same locality differing as much or more than those from distant points. Neither are the differences greater nor different in kind from those New England specimens of the common fox (*Vulpus fulvus*), the woodchuck (*Arctomys monax*), the northern hare (*Lepus Americanus*), or the gray rabbit (*L. sylvaticus*), present, and which in some of these species are sometimes exceeded.

\* "In the lack of perfect specimens of the North American wolf, I find it very difficult to throw any light upon the long-vexed questions of our species, all before me being mutilated in some way, and not allowing a satisfactory comparison with each other and with descriptions." — *N. Am. Mam.*, p. 105. After stating his conclusions in regard to the matter, however, he in a later paragraph mentions the receipt of additional specimens from the Yellowstone River.

† But one species, the *Gulb luscus*, is admitted in the Report on North American Mammals, as specifically identical with any species of the Old World. In this case a strong probability, in his estimation, of distinctness is hinted at.

The variations, particularly in point of color, presented by the species under consideration do not appear restricted to its American representatives, in the north of the Old World, the wolves, according to authors, varying from the white ones of Lapland and Siberia to the gray, pied, dusky, and even black ones of the more southern States; and here also the differences in color have been considered as indicating different species. In North America, where the wolf is quite fully known, the differences between the large white, or nearly white, races of the extreme north of the continent and the smaller dusky and rufous races of the south, in size, color, in the character of the pelage, and perhaps in other points, are so great that, without the intermediate links through which these widely differing extremes almost insensibly pass into each other, through individuals inhabiting the intervening districts, these extremes might be considered as well-marked species. At the far north, and "particularly in districts nearly destitute of wood," says Dr. Richardson, "wolves totally white are not uncommon," while grayish white is the prevailing color. The gray occupy, in general, the northern and elevated parts of the continent, including the elevated and more northern sections of the United States, and pass into the white and lighter gray wolves occupying the region farther north, and into the darker colored ones existing at the south. Southwards the color increases, tending more and more towards black and red, till in Florida\* and the Gulf States dusky and black wolves predominate, and in Texas red or rufous. Yet in no portion of the continent is the color of the wolves at all uniform, the same packs generally presenting a great variety in this respect, even those of the same litter often widely differing. Dr. Richardson mentions, under his "*variety sticte*," that of five young wolves, "leaping and tumbling over each other, with all the playfulness of puppies of the domestic dog," which he thought were probably of one litter, one was "pied, another entirely black, and the rest showed the common gray colors." In speaking of the black American wolf, which forms his "*variety ater*," he says the Indians do not consider them to be even a distinct race, but report that one or more black whelps are occasionally found in a litter of a gray wolf. Audubon and Bachman, in referring to the red wolf of Texas ("*Canis lupus* Linn. var. *rufus*" of these authors), state that this variety is by no means the only one found there, "where wolves black, white, and gray are to be met with from time to time. We do not think, however," say they, "that this red wolf is an inhabitant of the more northerly prairies, or even of the lower Mississippi bottoms, and have therefore called him the Red Texan

\* "The varieties, with more or less of black, continue to increase as we proceed farther to the south, and in Florida the prevailing color of the wolves is black." — AUDUBON & BACHMAN, *Quad. of N. Am.*, Vol. II, p. 130. These observations of Audubon and my own inquiries made during a recent journey in this State tend to confirm.



Wolf." On the Missouri we find, according to Lewis and Clark, that the wolves are chiefly yellow, as also, according to Professor Baird, on the Platte and Yellowstone (N. Am. Mam., p. 119), where they appear to gradually merge into the gray and white ones of the north. These latter evidently form the so-called varying wolf (*C. variabilis*) of Prince Maximilian,\* some of which, he says, are entirely white, others yellowish white, some more mixed with gray, and others still entirely gray, in the same pack. The black wolf noted by Say on the Missouri, and which he describes as *C. nubilus*, like the gray and white ones, seems to occur everywhere, but apparently much more abundantly at the south, thus corresponding in its distribution, as in general character, with the black variety of Southern Europe, described by Linnæus, and afterwards by Cuvier, as *Canis lycaon*. This name was also applied by Dr. Harlan to the American black wolf. The red, or rufous, seems likewise southern, occurring in great abundance in Texas, and thence northward through the middle region of the continent, passing gradually through paler rufous and yellowish to the prevalent gray and grayish-white wolves of the north. Though perhaps our data are at present too few to warrant positive conclusions on the subject, the facts appear to point rather strongly to a localization of these different colors; it is nevertheless true that, as already stated, the wolves present at every locality a wide range of variation, and that neither variety of color is entirely restricted to any particular region. The gray is apparently the most widely diffused, occurring in greater or less numbers almost everywhere.† We find, however, that authors have considered these color differences as indicating not only permanent varieties, worthy of distinctive names, but even species, as is shown by a glance at the subjoined table of synonymes of the American animal. Not a few, including Audubon, Bachman, Dr. Richardson, and others, have been so inconsistent as to name and characterize as "varieties" what they at the same time admit to be either positively or probably only individual variations, occurring sometimes in the same litter with the common form.‡

\* Reise in das innere Nord-Amerika, Vol. II, 1841, p. 95. Ib., Archiv für Naturgeschichte, Vol. XXVII, 1861, p. 247.

† Dr. Cones observes, in a series of interesting papers on the "Quadrupeds of Arizona," in the American Naturalist (Vol. I, p. 288), that all the wolves seen by him in Arizona were of the grizzly or grayish-white variety, which in winter, at a distance, appear almost white.

‡ Dr. Richardson, after saying "these variations of color, however, not being attended with any differences of form, nor peculiarities of habit, I deem them to be no more characteristics of proper species, or even permanent varieties, than color would be in the domestic dog," proceeds at once to formally name and describe five "varieties," as though they were tangible, permanent forms,—so great apparently is the fascination to some minds of bestowing names, to be followed by their own as authority, in Natural History.

In some previous citations of the synonymes of this species, I find that Dr. Richardson has on several occasions been incorrectly quoted, first by De Kay and afterwards by Baird; his name, *Canis lupus, occidentalis*, having been rendered by them "*Canis (Lupus) occidentalis*," thus incorrectly conveying the impression that he regarded the wolf of North America as distinct from the European, and as also having placed it in a sub-genus (*Lupus*) of *Canis*. Dr. Richardson, however, expressly states that he did not regard them as distinct, and did not wish to further burden the science by imposing a new name to indicate what at most he thought might be but a geographical race.

### *Canis lupus.*

*Canis lupus* LINNÆUS, Syst. Nat., I, 1767, 58.

" *mexicanus* IB., 60.

" " SHAW, Gen. Zoöl., I, 1800, 296.

" " DESMOREST, Mam., I, 1820, 199.

" " FISCHER, Syn., 1829, 183.

" " BERLANDIER, Proc. Acad. Nat. Sc. Phil., V, 1851, 157.

" *lupus, albus* SABINE, Franklin's Journ., 652.

" *lupus, griseus* IB., 654.

" *lupus, occidentalis* RICHARDSON, Faun. Bor. Amer., I, 1829, 60.

" " " var. A, *griseus*, IB., 66.

" " " " B, *albus*, IB., 68.

" " " " C, *stictæ*, IB., 68.

" " " " D, *nubilus*, IB., 69.

" " " " E, *ater*, IB., 70.

" *lupus* HARLAN, Faun. Amer., 1825, 84.

" *lupus*, var. *ater* AUDUBON and BACHMAN, Quad. N. Am., II, 1851, 126, pl. 67.

" " " *albus* IB., 156, pl. 72.

" " " *rufus* IB., 240, pl. 82.

" " EMMONS, Quad. Mass., 1838, 26; IB., 1840, 28.

" *nubilus* SAY, Long's Exped. R. Mts., I, 1823, 168.

" " HARLAN, Faun. Amer., 84.

" *lycaon* IB., 126.

" *variabilis* MAXIMILIAN, Reise in das innere Nord Amer., II, 1841, 95.

" " IB., Arch. Naturgesch., XXVII, 1861, 247.

" *gigas* TOWNSEND, Journ. Acad. Nat. Sc. Phil. (2d series), II, 1850, 75.

" *occidentalis*, var. *griseo-albus* BAIRD, N. Am. Mam., 1857, 104, pl. 31.

" " " *nubilus* IB., 111.

" " " *mexicanus* IB., 113.

" " " *ater* IB., 113.

" " " *rufus* IB., 113.

*Lupus occidentalis* DE KAY, Nat. Hist. N. Y. I, i, 1842, 42, pl. 26, fig. 2.

4. *Vulpes vulgaris*. (*V. fulvus* RICH., and of most modern authors.) RED FOX. More or less common throughout the State.

The varieties called "Silver Fox," "Black Fox," and "Cross Fox," are taken at long intervals.

These so-called varieties, to which have been given such distinctive names as *Canis decussatus*, *C. argentatus*, *C. fulvus* var. *decussatus*, etc., etc., and which some authors have regarded as species and the majority as permanent "varieties," are but different degrees of melanism of the common red fox, as they sometimes all occur in the same litter of young.\* They appear exactly parallel to the dusky and black varieties of marmots, which are usually considered as only variations of this character. The dusky of the preceding species (*C. lupus* Linn.) and the black form of several species of *Sciurus* are probably but the result of the same tendency more highly developed. Foxes in other countries, and particularly the European, are well known to present corresponding dusky and black variations, which have likewise been described as permanent varieties, and even as species.

Respecting the identity of the red fox of North America with that of Europe there is a diversity of opinion. Most of the old authors considered them specifically the same, while later they were almost as generally regarded as distinct. Recently their identity has been maintained by several high authorities in Europe, among whom are Giebel, Wagner, and Maximilian, and not without a fair show of reason. Professor Baird observes, that careful comparisons of the two show "appreciable differences, although the resemblance is very close in external appearances, and scarcely to be expressed except comparatively."† The

\* Audubon and Bachman, in their account of the Cross Fox ("*Vulpes fulvus* Desm., var. *decussatus* Pennant"). in Quadrupeds of North America (Vol. I, pp. 52, 53), incidentally relate the following: "In the spring we induced one of our servants to dig for the young foxes that had been seen at the burrow which was known to be frequented by the Cross Fox. With an immense deal of labor and fatigue the young were dug out from the side of a hill; there were seven. Unfortunately, we were obliged to leave home, and did not return until after they had been given away and were distributed about the neighborhood. Three were said to have been black, the rest were red. The blackest of the young whelps was retained for us, and we frequently saw, at the house of a neighbor, another of the litter that was red, and differed in no respect from the common Red Fox. The older our little pet became the less it grew like the Black, and more like the Cross Fox. It was, very much to our regret, killed by a dog when about six months old, and, as far as we can now recollect, was nearly of the same color as the specimen figured in our work."

In the following autumn the female was killed: "It was nearly jet black, with the tip of the tail white. This was the female that produced the young we have just spoken of; and as some of them, as we have already said, were Cross Foxes and others Red Foxes, this has settled the question in our minds that both the Cross Fox and Black Fox are mere varieties of the Red."

† Mamm. of N. Am., p. 126.

differences in the color and texture of the fur, to which he and others have called attention, seems the most tangible difference, though not one of high value. Several specimens from different parts of Europe, in the Museum of Comparative Zoölogy, show that some of the other differences specified by Professor Baird, particularly that of the form of the tail and the greater length of its hairs in the American animal, are far from constant, there being no such differences in this respect between them and others from the United States, as has been claimed. One of the European has the tail remarkably full, the longer hairs being fully an inch longer, instead of an inch shorter, as according to authors they should be, than average American specimens. Prince Maximilian has also observed that this distinction in regard to the form of the tail is inconstant and invalid.\* While, as Professor Baird remarks, European specimens can be readily separated from American, as in the case of most species commonly admitted as identical on the two continents, it does not follow necessarily that they are specifically distinct, since in very many species of animals specimens from not very remote localities can be similarly distinguished, where naturalists never question their identity. The very exact agreement in the southward distribution of the red fox in the Old World and in the New, — their southern limitation on both continents, as nearly as can be judged, coinciding with the same isotherm, — and the occurrence of the same varieties, as “cross,” “black,” and “silver,” and in about the same relative proportion of individuals, if indicating anything, seems to point to their identity. In considering this subject it is necessary to take into account the remarkable tendency to variation presented by other members of this family in a state of nature, and the readiness with which widely distinct breeds are developed under domestication in the common dog. The European specimens to which we have referred differ considerably among themselves, these differences being in some cases greater than between some of them and the average type of the American animal. I hence do not hesitate to consider the North American red fox as identical with the common red fox of Europe, the average amount of difference being not greater than might be anticipated in specimens from so distant localities.

5. **Vulpes virginianus** DE KAY. GRAY FOX. Though essentially southern, this species is said by De Kay to be rather common in the southern counties of New York, and particularly on Long Island; † Audubon and Bachman give it as not uncommon in the vicinity of Albany, N. Y., but as scarce in New England, and state

\* Arch. für Naturgesch., XXVII, Theil 1, p. 259.

† Zool. of New York, Vol. I, p. 46.

that they had not heard of it to the north of the State of Maine.\* Dr. Emmons gives it as "rare in Massachusetts."† Mr. C. W. Bennett informs me that he knew of the capture of two specimens in Leominster a few winters since. The skins of this species frequently seen in our fur stores come, so far as I have learned, altogether from Eastern Virginia and the Southern Atlantic States.

### MUSTELIDÆ.

6. **Mustela Pennantii** ERXL. (*M. canadensis*, Emmons Rep.; *Martes*‡ *Pennantii* Gray.) FISHER. Probably still of rare occurrence in the Hoosac ranges. In 1840 Dr. Emmons wrote: "It is occasionally found in the vicinity of Williamstown, particularly in that range of mountains which extends northeast through Stamford, Vermont."§

This species seems to be the only one of the old Linnæan genus *Mustela* (*Martineæ* of recent authors) peculiar to the northern parts of North America, with no very near ally in the corresponding portion of the Old World.

7. **Mustela martes** LINN. (*Martes americana* Gray; "*Mustela americana* Turton" of recent American authors; *M. zibellina* Brandt.) PINE MARTEN. SABLE. Occasional in the mountains of Berkshire County. Thirty years since Dr. Emmons mentioned it as not infrequent there, but as most common "where pine forests abound. It is, however," he says, "often found in beech woods, where it is sure of a more ready supply of food. Its nocturnal habits, and native shyness, effectually screen it from observation, even in districts where it abounds."||

The variations presented by the sables and martens, at single localities as

\* Quad., Vol. I, p. 172.

† Rep., p. 31.

‡ Each of the three generally recognized genera of the sub-family *Martineæ* ("tribe *Mustelina*" of Gray)—*Mustela* embracing the sables and martens; *Putorius*, the minks, weasels, and ermines, and *Gulo*, the wolverine—has been recently subdivided, the sections being ranked by some as sub-genera, and by Dr. J. E. Gray as genera. In his Revision of the Genera and Species of *Mustelidæ* (Proc. London Zool. Soc., 1865, pp. 100–154), he restricts *Mustela* to the weasels and ermines, and *Putorius* to the polecat, while the sables and martens he places under *Martes*, and the minks under *Vison*; the distinctions, based on differences either in the dentition, form of the skull or color, are, however, very slight.

§ Rep., p. 39.

|| Rep., p. 41.



well as in different districts, have been very perplexing, and have given rise to a considerable number of supposed species and a very great number of "varieties," the alleged distinctions between which are quite uncertain and inconstant. Some of these variations are doubtless referable to seasonal changes,\* and not a few others to individual peculiarities. Dr. Gray admits six species as inhabitants of the North Old World,† several of which he divides into three to five varieties each. To a few of them only, however, does he assign separate geographical districts; in general they vary in such a way as to render the forms recognized by him as species quite intangible, the varieties forming gradations between them. Two of the three attributed to Japan (*Martes japonica* and *M. brachyura*) rest on exceedingly unsatisfactory data, while the third (*M. melanopus*) has a striking resemblance to the common form of the American species, and to varieties of both the so-called *M. abietum* and *M. zibellina* of Europe and Asia. Aside from these divisions of Dr. Gray, three principal races or forms (species of many writers) have for a long time been recognized as occurring on the Eastern continent,—the sable (*Mustela zibellina* Linn.), the pine marten (*M. martes* Linn.), and the beech marten (*M. foina* Brisson; *M. martes*, var. *fagorum* Linn.). The principal distinctions between them consist in the relative length of the tail, which varies in being sometimes longer, equal to, or shorter than the body, and in the color, which varies in general tint, and differently in the different regions of the animal, and especially on the throat, which is sometimes white, or nearly so, but more commonly yellowish or yellowish-brown; occasionally the "throat patch" is nearly obsolete. The color of the head is sometimes like that of the body, and again much lighter; the general color varies from blackish through different shades of brown to light yellowish brown and whitish. But instead of either of these differences being limited, or peculiar, to either "species," "variety," or race, or to special localities,\* they are all given by Dr. Gray under the five divisions of his fifth species,—"*Mustela zibellina* Linn."; while he says of his *M. abietum*, var. *altaica*, that it is "intermediate between *M. abietum* and *M. zibellina*; but the feet are not so hairy"!\* Brandt, in his Beiträge Säugtheire Russlands, recognizes three species. The American animal (*M. americana* auct.) he considers as a yellowish or more yellowish-brown and less densely furred variety of the Asiatic sable than as a pure marten (*M. martes*), and calls it *Mustela zibellina*, var. *americana*.

Dr. Gray of course regards the American as distinct, and divides it into three varieties,—*abietinoides*, *huro*, and *leucopus*.—which seem to vary only in intensity of color, the first being "black-brown," the second

\* See *postea*, pp. 165–167.

† Proc. Lond. Zool. Soc., 1865, p. 104.

"yellowish-brown," and the third much lighter than the second. The habitat of the first is given as the "Rocky Mountains"; of the second, "Fort Franklin"; that of the third is not stated, and may be supposed to be general, or at least those districts not occupied by the others. It is evident, however, that these different varieties are not local, as they occur more or less frequently at the same localities, and likewise at as distant points as the two sides of the continent. Dr. Gray refers to a series of specimens of the American pine marten in the British Museum, collected by Dr. Lord during his excursion with the Boundary Commissioners, that "vary greatly in color, from pale brown to nearly black," and have "the throat variously mottled with yellow."\* Mr. Bernard R. Ross says that the farther north the skins are obtained the darker the pelage, and that on the Youkon River they strongly resemble the Siberian sable.† While in general the specimens from North America are of the white-headed or sable, rather than of the marten, type, dark-headed ones also occur, not exclusively on the western side of the continent, as some have supposed, but more or less frequently at all points.

Professor Baird has described ‡ specimens from the West Coast that do not differ essentially from others from the Adirondacks, though having the head much less white. Dr. Brandt's series of American skins from the Northwest Coast, as far south as Columbia, on the contrary, had the head very light colored, and hence resembled in this respect the generality of specimens from New York, Maine, and Nova Scotia. In other general characters he also found a close agreement with the Asiatic sable, and, as already stated, he believed them specifically identical. Dr. Gray also mentions a close resemblance in the color of the head between specimens from Russia and the Northwest Coast of America. Professor Baird, after comparing American with Swedish specimens, states that "in some respects, as in certain features of the skull and teeth, the American marten approximates to the beech marten, *M. foina*, more than to the European true marten"; and that it differs from the latter (*M. martes*) in certain proportions of the skull, in the texture and paler colors of the pelage, in the relatively longer tails of the latter, and in the extent of the naked pads of the feet. He also finds resemblances in color to the Russian *M. zibellina*, but finally concludes, after quoting Dr. Brandt's reasons for considering them identical, by saying that he is "far from admitting the identity of the American marten with the Russian sable, although it occupies a position intermediate between the latter and the *M. martes* in size,

\* L. c., p. 107.

† List of Mammals, Birds, and Eggs observed in the McKenzie's River District. Nat. Hist. Rev., July, 1862, p. 272.

‡ Mam. N. Am., p. 153.

length of tail and coloration, as well as in intrinsic value of the fur. The white-headed varieties of New York are most like the sable; the darker-headed ones of the Western country like the pine marten." He is "inclined to the belief," he says still later, in an interpolated note, "that we have two species, one representing the pine martin, with dark head, the other similar to the sable, with whitish head, — both probably distinct from the corresponding Old World species, the martens at least."

In Dr. Brandt's diagnosis of the martens, the relative length of the tail is dwelt upon as an important character. In *M. zibellina* the tail without the hairs is given as one third the length of the body; in *M. martes*, one half or more than one half. Professor Baird says the tail vertebrae in *M. americana* are about one half the head and body; hence not differing much from the same proportion in *M. martes*, while quite different from the same in *M. zibellina*, which Dr. Brandt considers the *M. americana* to most resemble; while Dr. Gray observes that the tail of some of Dr. Lord's specimens from Western America is almost as short as it is in the Russian sable. A marked discrepancy is evident in these statements, explainable on the ground of the inconstancy of the distinction based on the relative length of the tail. Brandt also states that the *M. foina* differs from *M. martes* somewhat in general color (but apparently not essentially, considering the much wider differences in this respect his varieties of *M. zibellina* present among themselves), and in having the tail generally longer, with more vertebrae. Since, however, the number of tail vertebrae is far from constant in most mammals with this member considerably developed (as I have myself observed in the mice, squirrels, ermines, and foxes), this latter character must lose much of its weight till repeatedly verified. Dr. Gray says, in urging the non-identity of the American and Old World martens, that "It is curious that both Brandt and Baird seem to have overlooked the small size of the last tubercular grinder, which separates the American from the Old World pine martens"; a fact he claims to have discovered. From variations I have observed in this respect in our common *Mephitis*, it would be interesting to know whether Dr. Gray has found this difference constant in a considerable series, or whether the observation rests on a single specimen, as, in the same connection, he refers to "the skull of the American specimen we have in the Museum," in speaking on another point.

I have shown in the foregoing remarks that the martens and sables of the Old World and the New are not without close points of affinity in all essential particulars; that on both continents they present almost innumerable differences, principally in respect to color, but few of which, if any, appear to be geographical, or even constant; that on both continents the variations are similar; that the points of distinction between the supposed species are slight, and rest mainly on characters which in mammals are the most likely

of all others to be variable; that authors, in their statements and opinions, are widely discrepant and often contradictory; finally, that the American animal is most closely allied to the Asiatic, grading through it into the European. At present there seems to be no middle ground between considering all as forming one circumpolar species and admitting a considerable and indefinite number, since some of the so-called "varieties" seem as strongly marked forms as some of the "species." If we must consider the American as distinct from those of the Old World, we can hardly do less, on parallel grounds, than to recognize two or more in America. It seems probable that in time the greater part will be found to be not permanent or uniformly transmissible varieties, but merely irregular individual variations;—in other words, that more than one so-called variety may be represented in the same family, as has been shown is the case in the foxes and wolves, and as is well known to occur in *Mephitis*.\* The comparison of a great number of specimens from many localities will be necessary before we can consider the matter as satisfactorily settled.

Since writing the foregoing, I have met with a very valuable paper on the Fur-Bearing Animals of the Mackenzie's River District,† and another on the Martens and Weasels of Nova Scotia;‡ I have also had an opportunity of comparing a large number of skins of the Siberian sable with an extensive series of others from Hudson's Bay. Much additional information has been derived from these sources, which tends to confirm the opinion above expressed; namely, that most of the so-called varieties and species would prove to be based on seasonal and individual variations of a single circumpolar species. The writer of the first of these papers, Mr. Bernard R. Ross, is well known from his extensive Natural History explorations in the boreal regions of this continent, and his experience of thirteen years in this district as a successful trapper entitles his statements and opinions to more than ordinary weight. He seems to have been a critical observer, and in this paper adds much to our knowledge of the fur-bearing animals of North America. His remarks on the seasonal changes in the color and character of the fur in several species are particularly valuable. The following extracts from them explain to a great extent the nature of the wide variations which, in many characters, the martens and sables everywhere exhibit.

\* See *postea*, p. 173 *et seq.*

† A Popular Treatise on the Fur-bearing Animals of the Mackenzie's River District. By BERNARD ROGAN ROSS, C. T. — *Canadian Naturalist and Geologist*, Vol. VI, January, 1861, pp. 5–36.

‡ On the Mammals of Nova Scotia, No. III. By Dr. J. BERNARD GILPIN. — *Transact. Nova Scotia Inst. of Nat. Science*, Vol. II, Part I, pp. 8–16.

"It is difficult to describe," he says, "the color of the marten fur accurately. In a large heap of skins (upwards of fifty) which I have just examined minutely, there exists a great variety of shades, darkening from the rarer yellowish-white and bright orange into various shades of orange-brown, some of which are very dark. However, the general tint may with propriety be termed an orange-brown, considerably clouded with black on the back and belly, and exhibiting on the flanks and throat more of the orange tint. . . . The ears are invariably edged with a yellowish-white, and the cheeks are generally of the same hue. The forehead is of a light brownish-gray, darkening towards the nose, *but in some specimens it is nearly as dark as the body.*\* The yellowish marking under the throat (considered as a specific distinction of the pine marten) is in some *well defined*, and of an *orange tint*, while in others it is *almost perfectly white*. It also varies much in extent, reaching to the forelegs on some occasions. At other times it consists merely of a *few spots*, while in a third of the specimens under consideration it is ENTIRELY WANTING." In respect to other characters he observes: "The tail is considerably less than half the length of the body *generally*, though it is sometimes longer; it is well covered and tolerably bushy. The feet are comparatively large, densely covered with short woolly fur, mingled with stiffer hairs, which prevent the naked balls from being visible in winter, *though they are distinctly so when the animal is in summer pelage.*"† Respecting the seasonal changes he says: "When casting its hair the animal has far from a pleasing appearance, as the under fur falls off, leaving a shabby covering of the long, coarser hairs, which have then assumed a rusty tint. . . . After the fall of these long hairs, and towards the end of summer, a fine, short fur pushes up. When in this state the pelage is very pretty, and bears a strong resemblance to a dark mink in its winter coat." He further observes: "In summer, when the long hairs have fallen off, the pelage of this animal is darker than in winter. The forehead changes greatly, *becoming as deeply colored as any other part of the body, which is of an exceedingly dark brown tint* on the back, belly, and legs. The yellow throat markings are much more distinct at this season, but vary much both in color and extent, though in only our summer skins are they entirely wanting." Mr. Ross also adds, that the martens of the Mackenzie's River district "bear a greater resemblance to the sable of Eastern Siberia than to the martens of Europe, holding, as it may be with propriety said, an intermediate position."

Dr. Gilpin, in his paper on the Nova Scotian Mammals already cited, has the following remarks on the variations presented by different indi-

\* The italicizing in these quotations is my own.

† This may explain the differences in the hairiness of the soles pointed out by different authors, and claimed as a distinctive character of considerable importance.



viduals at the same locality: "When we begin to study this species, we soon find a very great variety in color, not only between the summer and winter specimens, but between winter skins themselves, that are all in the highest condition. Whilst they all coincide in what may be called typical marks, such as color of legs, tail, and especially ears, all of which have a very pale but conspicuous rim or border, *they vary much in color of face*, some having black, others faces so pale as to be nearly white, and the pale faces have a lighter brown color, and the orange throat much less vivid." Of seven skins described by this gentleman in detail, two "are nearly uniform mahogany brown" from the nose to the tail; the other five, though varying somewhat among themselves, are generally lighter, with much lighter faces, and the orange spot on the throat very bright, "almost fulvous." He adds that the skins from "Newfoundland and Labrador are much finer, darker in color, and more lustrous in pelage" than those from Nova Scotia.

Through the kindness of several of the fur-dealers of Boston I have had an opportunity to make a careful comparison of scores of skins of the Siberian sable from Russia with as large a series from the Territory of Hudson's Bay. The differences between them, although through the whims of fashion producing considerable difference in the mercantile value of the skins, are really quite slight. The fur of the Hudson's Bay skins is a little coarser, and the color slightly more rufous, with much fewer of the white-tipped hairs that in the Siberian skins are sometimes sufficiently numerous to give them a slight grayish cast, and which is considered to greatly increase their value. As one of the dealers practically remarked, they differ no more than the horses raised in Pennsylvania do from those bred in Massachusetts. Some of the skins of both varieties had tails much shorter than the average, showing the unreliability of this character. In a few instances this member was distinctly tipped with white, in both the Hudson's Bay and Siberian skins.

In the light of the now well-substantiated facts of a wide range of seasonal and intergrading, inconstant individual variation, it seems to me to be beyond reasonable doubt that, as I have already stated, the martens and sables, at least all thus far described, belong to a single circumpolar species, with possibly two or more well-marked and tolerably constant continental races.

8. **Putorius vulgaris** Cuv. (*Mustela vulgaris* Linn.; *Putorius pusillus* Aud. and Bach.) LEAST WEASEL. Rather rare. Far less numerous than the next.

9. **Putorius ermineus** Cuv. (*Mustela erminea* Linn.; *Putorius noveboracensis* De Kay; *Mustela Richardsonii* and *M. Cicognanii*

Bon.; *Putorius fuscus*, *P. agilis*, and *P. ermineus* Aud. and Bach.)  
COMMON WEASEL. ERMINE. Comparatively common. It varies considerably in size, like other members of this family, according to sex and age.

I have obtained specimens at Springfield, identified some years since as belonging to the three species currently admitted by American authors as inhabiting Eastern North America, — "*P. Richardsonii* Bon.;" "*P. Cicognanii* Bon.," and "*P. novboracensis* De Kay." I have not access to the specimens for re-examination, but that these forms, or so-called species, occur in Massachusetts there can be little doubt, since Professor Baird, in his Report on the Mammals of North America, cites eleven examples from Middleboro', collected by Mr. J. W. P. Jenks, of his *P. Cicognanii*, two of *P. Richardsonii* and one of *P. novboracensis*. As indicated by the synonymy already given, I consider all these as forming but a single species, which, after careful comparison of American with European specimens, I fully believe to be identical with the ermine (*P. ermineus*) of the Old World. I also feel obliged to consider the common American weasel, after similar comparisons, as identical with the common weasel (*P. vulgaris*) of the Eastern continent.

Although three species of ermines, or stoats, have been supposed to inhabit New England, in common with Eastern North America generally, no constant character has yet been indicated by which more than a single one can be positively distinguished. In size there is an almost imperceptible gradation from the smallest specimens to the largest, and similar gradations in all other characters, not excepting the relative length of the tail to the body. This latter character and that of size have formed the two distinctions most strongly urged as specifically separating them.

Previous to 1838, all the known weasels of North America were considered as belonging to two species, identical with the *Mustela vulgaris* and *M. erminea* of the Old World. At this time Bonaparte, in his Fauna Italica, added a third, which he called *Mustela Cicognanii*. He gave of it the following short and very unsatisfactory diagnosis: "*M. rufo-cinnamomea*, *subtus flavo-albida*: *cauda corporis dimidio sub-breviori, apice nigricante*"; which contains the single tangible character of "tail rather less than half the body." In the same year, in Charlesworth's Magazine of Natural History,\* he added a fourth, which he called *Mustela longicauda*. This species was based on a variety mentioned in the Fauna Boreali-Americana,† by Dr. Richardson, as differing from the common ermine in being larger and in having a longer tail. Bonaparte, in the same communication, changed the name of the ermine weasel of Rich-

\* Vol. II, p. 38.

† Vol. I, p. 47.

ardson's work from *M. erminea* to *M. Richardsonii*, he believing them to be distinct species, and thus separated all the larger American weasels from those of the Old World. At this point begins the uncertainty and confusion that has long existed in regard to the number of species of American weasels and their distinctive characters. But no changes were currently adopted by American authors till ten or twelve years later, when, in 1841, Audubon and Bachman, in the Proceedings and Journal of the Philadelphia Academy of Natural Sciences, described a specimen taken on Long Island, New York, as a new species, under the name of *Mustela fusca*.\* In the following year Dr. De Kay, in his Report on the Mammals of New York, redescribed this specimen under the name applied to it by Audubon and Bachman, and at the same time separated the larger representatives of the ermine as a species distinct from the Old World ermine and from the supposed northern *M. Richardsonii* of Bonaparte. But this author very frankly adds: "I have never seen the true ermine in its summer dress, and only know it from Pennant's description (Arct. Zool., Vol. I, p. 75)." He calls the American ermine weasel *Putorius noveboracensis*, and regards it as differing generically from two other species of weasel (*M. pusilla* = *M. vulgaris* Linn, and *M. fusca* Aud. and Bach.) described by him as also inhabiting New York. In 1853, the authors of Viviparous Quadrupeds of North America, in the third volume of that work (p. 184), characterized another species as new, also from New York specimens, which they called *Putorius agilis*. In the same volume, under *P. fuscus*, they observe that whereas the number of North American weasels was believed by the older authors to be at most two, while some admitted but one, "there are now five, four of which are found in New York." If we add to the new names of Audubon and Bachman and De Kay the three bestowed on American weasels by Bonaparte, we have seven specific designations for those of Eastern North America alone; to these may be added *P. erminea* and *P. vulgaris*, Audubon and Bachman fully believing these species to be common to both continents, thus making nine.

This was the condition of the subject when Professor Baird revised the group in his Report on the Mammals of North America, in 1857. In this work eight species are admitted as inhabitants of North America. Two (*P. frenatus* and *P. xanthogenys*) are considered as exclusively southern and western in their distribution; one (*P. Kanei*) as northwestern ("Behring's Straits and Siberia"), and three *P. Pusilla*, *P. Cicognanii*, and *P. Richardsonii*) as distributed throughout the northern parts of the continent and extending southwards into the United States. Another (*P. noveboracensis*) is regarded as ranging from Massachusetts and Northern New

\* Proc., Vol. I, p. 92; Journ. Vol. VIII, 1842, p. 280.

York, west and south, to Southern Pennsylvania, Illinois, and Arkansas. The locality of still another is given as Carleton House, H. B. T., this being the variety described by Richardson as occurring at that locality, and named *Mustela longicauda* by Bonaparte. But Baird doubtfully refers to it also some long-tailed ermines from the Upper Missouri.

Concerning the Least Weasel (*P. pusillus* Aud. and Bach. of Baird's Rep.), the only queries relating to it have been principally in reference to its relationship to *P. vulgaris*, *P. pusillus* forming its principal synonyme. Bonaparte, however, doubted its occurrence in America, supposing his *P. Cicognanii* had been generally mistaken for it, as he claims he found it had been in some of the Middle States, and on his authority Dr. Godman excluded it from his American Natural History. Afterwards, however, Dr. Richardson, in the Zoölogy of Beechey's Voyage, applied to it the name of *P. Cicognanii*.

For the smaller weasels with a distinct black tip to the tail, Professor Baird retains the name of *P. Cicognanii*, referring to it the *Mustela* (afterwards *Putorius*) *fusca* of Audubon and Bachman. He gives as its distinctive character, "Length to tail, eight inches or less. Tail vertebrae, one third this length. Black of tail, two fifths its length," etc. He adds, this "species is readily distinguished from the other American weasels by the small size, and the tail, which, with the hairs, is rather less than half the body." In a note he mentions the later reception of some hunter's skins from Nova Scotia and Labrador, among which were some that agreed very well with typical specimens from Massachusetts, while others were considerably larger, though in general preserving the same proportions. The average length of the body in the measurements of twelve specimens given by him is 8.25 inches, the largest being 10, and of tail 3.62; but between the extremes of the series there is a variation in total length of thirty-six per cent. of the average, and in the relative length of tail to the body of twelve per cent.

*Putorius Richardsonii* is characterized by the same author thus: "Length to tail, nine inches or less. Tail vertebrae, about half this length. Black of tail, nearly one half to one third its length," etc. "Is readily distinguished from *Putorius Cicognanii* by the longer tail, the vertebrae alone of which are fully half the length of the body, instead of requiring the entire tail to effect this proportion."\* Of this "species," the measurements of two speci-

\* In the account of *P. Richardsonii* in the Mammals of North America there occurs the following singular but important discrepancy, probably the result of a typographical error. In the third paragraph of page 165 it is stated, "This species, a true *Putorius* differs materially from the larger North American Weasels in the absence of a black tip to the short tail; in this respect resembling *P. Cicognanii*." But in the specific diagnosis of *P. Richardsonii* the author says: "Black of tail nearly one half to one third its length"; and in that of *P. Cicognanii*, "Black of tail two fifths its length."

mens from Eastern Massachusetts are given, both of which, in general size, fall within the average of the twelve of *P. Cicognanii*; thus showing that "small size" fails to sufficiently distinguish the latter, and also that short tails and small size do not always go together in specimens from the same locality; the tails in these two exceed the average in the *P. Cicognanii* by about thirty per cent. of the average of the whole series. The distinction based on the relative length of the black tip seems also intangible, "two fifths" coming just between "nearly one half" and "one third." To this species he refers the *P. agilis* of Audubon and Bachman, and of course the *Mustela (Putorius) erminea* of Richardson, for which the name *Richardsonii* was substituted by Bonaparte for *erminea*. Yet the dimensions given by Richardson accord in the proportions of the tail to the body, not with Baird's diagnosis of *P. Richardsonii*, but with that of *P. Cicognanii*, the tail vertebræ being but little more than one third the body, and the hairs and vertebræ together being less than one half.\*

*Putorius noveboracensis* of Baird's Report is characterized as "Length to tail about ten inches. Tail vertebræ about half this length. Black of tail about half its length," etc. It thus differs from the last only in being larger. Yet one of the three specimens of which measurements are given scarcely exceeds the size of the larger of the two specimens of *P. Richardsonii*, and falls considerably below several of the *P. Cicognanii* in length of body. One of the *P. Cicognanii* specimens even equals the average of those of *P. Richardsonii*, although *P. Cicognanii*, as previously observed, is supposed to be distinctively characterized by its small size. Some differences in the proportional length of the feet, and in the color, are mentioned as existing between this and *P. Richardsonii*, but they are evidently merely individual, and would disappear in a comparison of a large series. To this species he refers the *P. ermineus* of Audubon and Bachman and the *P. noveboracensis* of De Kay.

In comparing some of the "*noveboracensis*" specimens with a short-tailed one of the European *P. ermineus*, I am not surprised that Professor Baird found "very decided points of distinction," "notwithstanding the assurance of authors" to the contrary. The principal one mentioned, however, is the greater brevity of the tail in the European, in which the proportion of the tail to the body is about as it is in *P. Cicognanii*.

In *Putorius longicaudus* the dimensions are given as, "Length to tail about eleven inches. Tail vertebræ about half this length. Black of tail about one fourth its length," etc. The measurements given of three specimens average 10.78 inches in the length of the body, one only reaching eleven, while the tail vertebræ alone equal fully half of this length. It

\* "Length of head and body, 11 inches; of tail (vertebræ), 4 inches; of tail, including fur, 5 inches." — *Faun. Bor. Am.*, Vol. I, p. 47.



differs, then, from *P. Richardsonii* only in its slightly larger size, the *proportion of length of tail to length of body being essentially the same in both*. Some smaller specimens are referred to this from the Upper Missouri, of which measurements are not given. Two of the large specimens are marked males; the sex of the other is not indicated. To this species is of course referred the long-tailed Carleton House variety mentioned by Richardson, to which, as already observed, Bonaparte gave the name *longicauda*.

From the preceding comparisons and remarks the inconstancy and the arbitrary character of the distinctions claimed as specific are fully evident. It appears that short tails by no means always accompany small size, nor long tails large size; that both occur at the same localities, as well as at points as remote from each other as the most distant localities at which the species has been found, as Hudson's Bay Territory and the Arctic Regions on the one hand and Massachusetts, Pennsylvania, and Illinois on the other; that between the "species," as characterized by Professor Baird, there is an almost insensible intergradation in all the essential characters, some of the so-called species resting on distinctions that are by no means differences (as *P. Richardsonii* and *P. longicauda*; *P. Cicognanii* and *P. noveboracensis*, very nearly); finally, that, contrary to the belief of this author, the short-tailed species (*P. Cicognanii* and *P. noveboracensis*) have a range to the northwards equal to that of the others, the *P. erminea* of Richardson being distinctly referable in its proportions to *P. Cicognanii*.

Although differing radically with the eminent author of the Report on the Mammals of North America in respect to the number of valid species of this group in America,—the only American zoölogist who has given it special attention,—I can but commend the candor he has exhibited in his attempt to clear up the discrepancies of former authors, and to sift the subject of its obscurities, as well as the manner in which he has presented his material.

An examination of numerous specimens from the New England and other Northern States has shown me that the variations in the relative length of the tail to the body are merely analogous to similar individual variations in the squirrels and other small mammals that have this part considerably developed,—a variation not always due merely to the lengthening or shortening of the vertebral segments, but occasionally to an increased or diminished number of the vertebrae themselves. Also, that the variation in size so noticeable in specimens from the same locality is in great part sexual,—the males in nearly all species of *Mustelidae* being considerably larger than the females,—but in many cases to immaturity, and somewhat also to the natural individual range in this respect,

which, as in their allies, the mink and marten, and in the Carnivora generally, is much greater than in some other groups. The differences in color claimed now and then as distinctive of different species are generally either such as are evidently seasonal, or such as, like those of the form and proportions of the feet, etc., would disappear in a large series. I hence feel convinced of the existence of but two species of weasels in Northeastern North America, and that these are circumpolar, identical with the *P. vulgaris* and *P. ermineus* of the Old World. These two are always distinguishable with certainty, while their representatives do not present a wider range of variation in size and other characters than is currently admitted for several of their congeners. More than this number being admitted, the whole question as to how many should be recognized, and what constitutes their distinctive characters, becomes involved in the greatest uncertainty.

Two interesting facts in respect to color in the weasels should not in this connection pass unnoticed. One is that both species generally become white in winter: apparently invariably so at the far North, and usually so as far south as Northern New England, but in Massachusetts only the larger one (*P. ermineus*) thus changes, and this not always. Still farther south such a change in *P. ermineus* occurs only occasionally, and in the extreme southern portion of its habitat not at all.\* This whitening of the pelage in winter corresponds in geographical relation to the white or light gray color seen in the common wolf at the north, and the gradual darkening of its color southward. The other fact is the usual greater intensity of the yellow on the under parts in specimens from the central portions of the continent, — a variation parallel with the rufous form of the common wolf of the same region, and the comparatively more rufous tint of the pelage seen in specimens from the same district in most continentally distributed species.

Another fact in respect to size is also noteworthy, as corroborative of the general law of the larger size of the representatives of a species from the northern parts of its habitat than those from the southern. The measurements given of the length of the body by those authors who have had only southern specimens for examination is seven inches for *Putorius vulgaris*, and eight to ten inches for the corresponding measurement of *Putorius ermineus*, but Richardson, whose specimens were extremely northern, gives nine inches for the same measurement of the former, and eleven and twelve for that of the latter.†

\* Respecting this seasonal change of color, compare the observations of Richardson (Fauna Boreali-Americana), Audubon and Bachman (Quadrupeds of N. Amer.), and Baird (Mam. N. Amer.).

† Professor Baird, in order to reconcile the identification of Richardson's specimens with his *P. Richardsonii*, supposes the body to have been overstretched, as he says he never saw any American ermines that would measure eleven inches before skinning;

In concluding this brief review of the American weasels I will add that, whether *P. frenatus* and *P. xanthogenys* prove ultimately distinct from each other, as they are likely to from the northern species (*P. ermineus*). I regret to feel obliged to assign the *P. Kancii* Baird to the synonyms of *P. ermineus*, not less from my regard for its describer than for the memory of that admirable man its name is so appropriately designed to commemorate. To the same category I think must also be referred the *P. bocamelus* Bonaparte, founded on the southern race of this species in Europe (Sardinian specimens), as his *P. Cicognanii* was on a similar American race.

Since writing the above I have found that Dr. J. E. Gray, of the British Museum, has recently referred *Putorius Kancii* Baird to *Mustela erminea* Linn., it forming his "variety 2, *Kancii*" of this species.\* To the same species he has also referred the *Putorius noveboracensis* De Kay, and the *Mustela Cicognanii* and *M. longicauda* Bonap., he calling them altogether "variety 3, *americana*," of *ermineus*. Dr. Gray adds: "Dr. Spencer Baird, in his work on the Mammals of North America, divides the stoats into six species [*P. Richardsonii*, *P. noveboracensis*, *P. longicauda*, *P. Cicognanii*, *P. ermineus*, and *P. Kancii*], by the length of the tail and the black on the tail. . . . When the bodies of several English stoats have been compared they show how deceptive that character is. I do not say that they may not be distinct; but if they are, there must be other characters to separate them besides the mere length of the tail." He accordingly gives as "species 2" of the stoats, *Mustela Richardsonii*, on Professor Baird's authority, and as chiefly distinguished by the upper lips and legs being "entirely brown." He adds, "I have not seen this species." He further observes: "The specimen formerly named *M. Richardsonii* [by Bonaparte?], in the British Museum, has the hinder part of the upper lip white, but the hair is bent back and lost off the front part." In respect to the white on the upper lip, he states that English specimens sometimes have it reduced to a very narrow margin.

The American weasel (*P. pusillus* auct.) Dr. Gray likewise considers identical with the European *P. vulgaris*. But Bonaparte's *Mustela bocamela* of Southern Europe he admits as a valid species, under the section of weasels, or of species with the "back and tail uniformly colored," and extends its habitat to include North Africa (Algiers and Cairo). The correctness of this view seems highly questionable, since New England specimens of *P. ermineus* sometimes have the tip of the tail merely

forgetting apparently for the time being this law of variation which he was one of the first to recognize, and towards establishing which no one else has done so much.

\* Proc. Lond. Zool. Soc., 1865.

dusky, the black being almost obsolete, in which condition they seem not essentially different from the figure and original description of *P. bocamela* in the Fauna Italica.

10. **Putorius lutreolus** Cuv. (*P. vison* Gapper; *Vison lutrecephala* Gray; *Mustela lutreola* Linn.) MINK. Common.

I am not prepared to admit Audubon and Bachman's Little Black Mink (*P. nigrescens*) as distinct from the above. Specimens referable to this supposed species are not of uncommon occurrence. Mr. B. R. Ross considers that the *P. nigrescens* "is nothing more than the young of the *P. vison*,"\* an opinion I have also long entertained.

In this species we again have an animal of questioned identity, some authors considering it the same as the European *Mustela lutreola* Linn., while others maintain its distinctness. But the differences seem very slight, and have generally been supposed to consist in the front of the upper lip being white in the European, while there is no white on that of the American; in size, proportions, and general color, no one claims that they materially differ. This single character is one of great variability in their near allies, the ermines, some having the white margin of the upper lip very broad, while in others it is very narrow and occasionally entirely obsolete. The other white markings on the mink are notoriously variable, some specimens having this color restricted to a very narrow chin patch, or even *entirely wanting*, while in others there are spots of white on the throat and between the fore legs; in still others white spots occur also along the middle of the abdomen and between the hind legs, forming an interrupted median line of white patches. I also feel confident that I have seen specimens of the American animal with a white margin to the upper lip. Experienced trappers positively assure me that such examples are of occasional occurrence.† Dr. Gray, however, gives a second character of

\* Natural History Review, July, 1862, p. 273. In a later paper in the Canadian Naturalist and Geologist (Vol. VI, p. 30), Mr. Ross says the *P. nigrescens* of Audubon and Bachman are "merely common minks under three years of age." He states in another place (l. c. p. 29), "I have remarked that the color of this animal, as well as that of the otter and beaver, grows lighter as it advances in years, and that the white blotches or spots are of greater size and more distinct in the young than in the old. The color of a young mink (under three years), when killed in season, is very handsome; its color is often an almost pure black." I have myself observed a similar variation in color with age in the common black rat, and in other mammals, as well as in many birds.

† Since writing the above I find Mr. Ross says, in referring to Professor Baird's remark that the American mink *never* has the edge of the upper lip white, "I have never seen the *whole* of that part so colored, but in one specimen now on my table there is a white spot beneath the nostril."

distinction between the American and European animals, — a difference in the size of the upper tubercular tooth, — the value or constancy of which I have at present no means of determining.

Of the American animal Dr. Gray makes three "varieties." The first is dark, with unspotted throat and chest, whose habitat he gives as "Vancouver's Island"; but it also occurs in Massachusetts, Michigan, and Illinois, as I have myself observed, and probably throughout the habitat of the species. The second is characterized simply as having the "chin entirely brown," while the third is Audubon and Bachman's *P. nigrescens*. No special habitat is given for the last two. Neither of them, however, is a permanent variety. In the general color, as well as in the white spots, there is a wide variation, different specimens varying from pale brown to quite intense black. There is also an extensive variation in size, but as very large and very small individuals occur in each stage of color it is very difficult to consider any of these variations as other than individual, or such as are evidently to be referred to season, sex, or age.

Numerous supposed species of the Old World mink have also been characterized, chiefly from the warmer regions, five of which are recognized as valid by Dr. Gray. The first of these is the common *M. lutreola* of Linnaeus, the habitat of which is given as "Europe." The second is the *M. siberica* of Pallas, which Dr. Gray says is paler and smaller than *M. lutreola*, with the tail relatively longer and the end paler colored, or like the back, instead of darker than the back.\* He observes that it "varies greatly in the quantity of white on the chin and throat," and adds that the "*males are much smaller*." The last statement, if true, indicates a remarkable exception to the sexual law of variation in size in this family. The habitat is given as Siberia, Himalaya, Japan, China, and Formosa. Dr. Gray's third species is the *Mustela canigula* of Hodgson, originally described from specimens from the Nepaul Hills of India. Its chief distinction seems to be an unusual amount of white on the face, chin, throat, neck, and chest, although Gray mentions as a variety a specimen with darker fur and much less white. His fourth species, *Mustela (Vison) Horsfieldii* Gray, seems not to differ particularly from the others, or from frequent American specimens, as its "variety two" is characterized as "chin brown, *edge of under lip only white*." This is likewise from India (Bootan) and Japan. The fifth, from Nepaul, the *Putorius subhemachabua* of Hodgson, differs from the preceding in being generally lighter or redder, — in other words, having less intensity of color, — with minor differences in the amount and distribution of the white. If all these species are valid, it will be seen that Southern and Eastern Asia and Japan are peculiarly rich in species of this

\* The relative shade of color of the tip of the tail as compared with the back is a character too inconstant in this group to merit serious mention.



group.\* But, in view of the well-known similar variations presented by our American mink, they seem to rest on very unsatisfactory distinctions, especially as the "varieties" admitted under some of them cover the differences considered as distinctive of the different species. The general paler color and somewhat smaller size of the southern forms † is paralleled by similar differences in specimens of the American animal from the southern portion of its habitat. In view of all these facts, I strongly incline to the opinion that we have here again but one circumpolar and widely dispersed species, with possibly two continental or geographical races that may be more or less easily recognized. Else, as in similar cases previously discussed, we must admit an indefinite number, subject in this respect and in their limitation to the caprice of those authors whose forte is in the description of "supposed new species." ‡

# 11. *Gulo luscus* SABINE. WOLVERINE. Dr. De Kay, in his

\* It is a fact especially noteworthy that regions whose Natural History is considered as but partially explored are far richer in species (I refer more especially to mammals and birds), accepting only such as are currently allowed, than those much longer and more familiarly known. To be assured of this one needs but to compare Southern and Middle Europe with the corresponding parts of Asia, or Eastern and Northern America with Mexico and Central America, adopting as a basis for the comparison only those types or groups widely distributed. This fact is especially illustrated in the Carnivora, as the present family of *Mustelidae* exemplifies. While distinct types appear in different regions, as some in the warmer latitudes that are not found in the colder, and *vice versa*, the martens and sables, as well as the minks, under not very different physical conditions, far outnumber in Eastern Asia alone, in reputed species, their representatives in Europe. While I would not deny the possibility of this being a fact, the intimate relationship which these several supposed species bear to each other, as well as to the European, and the unsatisfactory distinctions on which they are founded, seem to render it extremely improbable. If we extend the comparison to other groups, and to other regions, we constantly meet with cases parallel in all respects to this. This excess of species also almost always happens, in mammals, among those least known, either through their great scarcity or their nocturnal or recluse habits rendering them difficult to obtain. The explanation of this seems to be that new species are not anticipated to occur in a region that has been for a long time thoroughly explored, while specimens from imperfectly known districts, or of species in groups where the species are supposed to be difficult to distinguish, are most critically examined, and those differing slightly from others previously described — though not more, in many cases, than specimens unquestionably of the same species and obtained at the same locality frequently do — are presumed to represent undescribed species.

† See Gray's table of comparative measurements of the skulls of his several species Proc. Lond. Zool. Soc., 1865, p. 118.

‡ In the mink, as in the marten, it is an interesting fact that the Asiatic specimens bear a stronger resemblance to the American than the European do. According to authors, specimens not unfrequently occur in Japan and portions of Eastern Asia that are hardly distinguishable from average American ones.

Report on the Mammalia of New York, published in 1842 (p. 28), says : "Professor Emmons states that they still exist in the Hoosac Mountains, Massachusetts." But the species is not given in Emmons's Report, published two years before ; it occurs, however, in Dr. Hitchcock's List, with the following note : "On Hoosac Mts. ; rare.—Emmons." It is more or less common from Northern New England to the Arctic coast.

This species is remarkable for being the only one in the Mammalian Fauna of the State usually regarded as common to both the Eastern and Western Hemispheres. The existence in all together of but two or three circumpolar species of land mammals is admitted by many naturalists. It must also present an unusual constancy of character, since not only has it escaped subdivision into pseudo-species, but even no "varieties" have been generally recognized.

12. **Lutra canadensis** SABINE. (*Lutra canadensis* Gray ; *Lutra canadensis* and *L. destructor* Barnston.\*) OTTER. Not rare ; still not often captured. At Springfield I have known some half-dozen specimens taken in the last ten years.

13. **Mephitis mephitis** BAIRD. (*M. chinga* Tiedemann ; *M. varians* Gray ; *M. mesomelas* and *M. chinga* Maximilian.) SKUNK. Abundant. Individuals from the same locality, and even from the same litter, are very variable in color, some being almost entirely black, while others have a very large proportion of white. The amount of baldness on the soles of the feet is also very variable, independently of season or age, although this has been deemed by some naturalists, as Lichtenstein and others, as a character of great importance. Attention has been previously called to its inconstancy.†

Probably no other North American mammal is so strikingly variable in color as the common skunk ; it is hence not surprising that foreign naturalists, unacquainted with the animal in life, have made of it a considerable number of supposed species. So well known is this variability to most persons at all familiar with the animal that it is all the more unexpected to find from a naturalist so justly reputed for accuracy as the author of the Report on the Mammals of North America a statement like the following : "This species varies considerably in its markings, though individuals from the same locality are usually quite similar."‡ Especially is this so after the

\* Canadian Naturalist and Geologist, April, 1863, p. 147.

† See Dr. J. E. Gray's Review of the Mustelidæ, Proc. Lond. Zool. Soc., 1865, p. 147.

‡ Mam. N. Amer., p. 195.

detailed account given by Audubon and Bachman of very wide differences in color between individuals of the same litter.\* The majority of the Massachusetts specimens I have seen accord very well with Professor Baird's diagnosis, the general color being black, with a narrow white streak down the face, a large white nuchal patch, and a broad white streak on each side of the back reaching commonly nearly to the tail, which is tipped with the same color. Sometimes the face streak is united with the nuchal patch, but oftener it is separated by a narrow space of black, and is occasionally absent. The dorsal streaks vary in breadth and posterior extent, generally enclosing a narrow band of black; but the latter is sometimes wanting, when they, uniting along the median line, form but one; they run nearly parallel or widely diverge posteriorly, where frequently each is deeply bifid; more frequently than otherwise they entirely cease near the loins. The nuchal patch also varies in form and extent; generally it is continuous with the dorsal streaks, but is often entirely separate from them, and is itself sometimes divided, forming two small lateral patches; its general outline is variable almost beyond description. The white on the tail is sometimes terminal and sometimes basal; now and then it is quite absent, but occasionally it preponderates over the black. The distinct terminal pencil of long white hairs in the tail, so often described, seems generally best defined in young specimens; in full-grown ones it is frequently absent. Individuals occasionally occur that are either entirely, or almost entirely, black; much more rarely others with nearly the whole of the dorsal surface white, as in a specimen in the Museum of Comparative Zoölogy, collected in Newton, Mass., by Mr. C. J. Maynard. This has the black restricted to a narrow dorsal line, a few scattering hairs in the tail and to the lower surface of the body, the white dorsal band being nearly two inches broad on the neck and seven at the loins. Mr. Maynard has another specimen, taken at the same locality, which has still more white, there being no black median line, and the white extends still lower on the sides of the body. In short, the variations in color in the skunks are almost endless, scarcely any two specimens being quite alike. It therefore seems preposterous to found species on particular styles of coloring, or on the relative proportion and distribution of white and black, as several authors have done.

Eight species were described by Lichtenstein in his monograph of the genus *Mephitis*† from Mexico and the United States alone, while from North and South America together he gave sixteen! Professor Baird recognized six in his Report, and mentions three others described by

\* Quad. N. Amer., Vol. I, p. 319.

† Ueber die Gattung *Mephitis*, Abhand. Akad. Wiss., Berlin, for 1836, 1838, pp. 249 - 315, and 2 plates.

Lichtenstein from Mexico as probably valid and also likely to occur in the United States. Dr. Gray\* has very judiciously reduced the number to five, including those of both North and South America, but he places them in what he considers three genera, — *Conepatus* (1837, nearly equal to *Thiommus* Lichtenstein, of subsequent date), *Mephitis*, and *Spilogale*. He gives all as occurring in North America. To the first, *Conepatus nasutus* Gray (*M. nasuta* of Bennett †), he refers, and it appears to me very properly, the *M. leuconota* and *M. mesoleuca* of Lichtenstein and Baird, and numerous other species of other authors, thus greatly reducing the number previously received. He separates it, however, into four "varieties," which are based on the distribution of the colors, although they seem to be about as uncertain in extent and relative proportion in this species as in the more northern one. Of *Mephitis* proper Gray gives three species, two of which (*M. vittata* Licht. and *M. mexicana* Gray, = *M. macroura* Licht.) are from Mexico, and the other (*M. varians* Gray, = *M. mephitica* Baird, = *M. chinga* Tiedemann) is generally distributed over North America, from Great Slave Lake ‡ southwards; of *Conepatus* and *Spilogale* one each. It is highly probable, however, that Mexico is not thus pre-eminently rich in species of these animals, and that Gray's two Mexican species may be referred to the common North American one, since they rest almost solely on distinctions of color that are far from peculiar to the Mexican examples. This being true, we have three supposed genera containing a single species each, or, what seems to me more probable, the alleged differences being slight, a single genus with three species, which agree rather closely in their general style of coloring and in possessing a remarkably large range of indefinite color variation. In distribution, one (*M. mephitica*) is northern, ranging from Mexico almost to the Arctic regions, and the others (*M. mesoleuca*, = *Conepatus nasutus* Gray, and *M. bicolor*) southern, inhabiting from Mexico and the Southern States to Patagonia.

Our common species (*M. mephitica* Baird) Dr. Gray divides into five "varieties," based on the relative extent of the white dorsal streaks, which form among themselves a graduated series. The inconstant nature of the characters assigned to these as distinctive it seems to me renders them unworthy of recognition, since they not only all occur at single localities, but, as Audubon has shown, § several of them sometimes appear in the

\* Proc. Lond. Zool. Soc., 1865, pp. 145 *et seq.*

† Ibid., 1833, p. 29.

‡ B. R. Ross, l. c., p. 273.

§ "In the winter of 1844 we caused a burrow to be opened in Rensselaer County, N. Y., which we knew contained a large family of this species. We found eleven; they were all full grown, but on examining their teeth and claws we concluded that the family was composed of a pair of old ones, with their large brood of young of the previous season. The male had a white stripe on the forehead; and from the occiput down the

same litter. Most of these pseudo-varieties and others of a similar character have been described by authors as distinct species. Prince Maximilian in his latest work \* still maintained the existence of two species, *M. mesomelas* Licht and *M. chinga* Tiedem., in the United States. The latter (*M. chinga*) he seems to have known only from imperfect skins brought by the Indians of the Upper Missouri from, as he presumed, the Red River of the North and the Saskatchewan. They were used by them as trappings for the legs, and were all very white, differing only in this respect from the common skunk. As specimens similarly colored occur more or less frequently throughout the United States, it seems more probable that the Indians may have selected skins of this color for the special use to which we are informed they applied them than that the skunks of any given region are generally so colored.

Without going into the synonymy of the subject in detail, I may add that for the common North American species Dr. Gray strangely adopts the specific name of *varians* (*M. varians* Gray, 1837), this name being superseded in priority by both *chinga* of Tiedemann (1808) and *americana* of Sabine (1823), as well by *mephitica* of Shaw (*Viverra mephitica*, 1792). This latter being the one first given, has very properly been adopted by Professor Baird.

## URSIDÆ.

### 14. *Procyon lotor* STORR.† RACCOON. Formerly numerous,

whole of the back had another white stripe four inches in breadth; its tail was also white. The female had no white stripe on the forehead, but had a longitudinal stripe on each side of the back, and a very narrow one on the dorsal line; the tail was wholly black. The young differed very widely in color; we could not find two exactly alike; some were in part of the color of the male, others were more like the female, whilst the largest proportion were intermediate in their markings, and some seemed to resemble neither parent. We recollect one that had not a white hair except the tip of the tail and a minute dorsal line." — AUDUBON and BACHMAN, *Quadrupeds*, Vol. I, p. 319. See also the two young figured by these authors (Plate 42), one of which has white stripes on the back and a black tail, and the other no stripes and the end of the tail white, though both were of the same litter. I have myself met with similar variation in the same litter of young.

\* Verzeichniss Nordamerikanischer Säugethiere, Archiv für Naturg., XVII, 2, p. 218.

† *Ursus lotor* LINNÆUS, Syst. Nat., I, 1758, 48, Ib., I, 1766, 70.

*Procyon lotor* STORR, Bod. Meth. Anim., 1780.

" *Hernandezii* WAGLER, Isis, XXIV, 1831, 514.

" " BAIRD, N. Am. Mam., 1857, 212.

" " IB., U. S. & Mex. Bound. Surv., II, Mam., 1859, 22.

" " var. *mexicana* BAIRD, Ib., 22.

" *lotor*, var. *mexicana* ST. HILAIRE, Voyage de la Venus, Zool., I, 1855, 25, pl. VI.

" *nivea* GRAY, Charlesw. Mag. Nat. Hist., I, 1837, 580.

" *psora* IB., Ann. & Mag. Nat. Hist., X, 1842, 261.



and still more or less common in the mountainous and sparsely settled parts of the State.

Quite variable in color, the variations on the one hand tending strongly towards melanism and on the other towards albinism. On specimens presenting the latter kind of variation seems to have been founded the *Procyon nicea* of Gray from Texas,\* as probably also the *P. psora* of Gray† from California.‡ With the variations in the general tint the markings usually become more or less indistinct. In even what may be considered as the normal or average type the dark rings of the tail vary from four to six in number, in intensity of color, and in relative breadth to the interspaces; sometimes the dark rings are only about half the width of the intervening lighter ones, but, as I have observed to be the case in numerous specimens killed in Massachusetts, Western New York, and Florida, they often equal, and not unfrequently exceed them. The tail varies also in its form and size, as it does in the foxes and marmots, sometimes tapering considerably towards the tip, though generally but slightly. Yet these characters have been assumed by some authors to be indicative of specific differences, the *Procyon Hernandezii* of Wagler§ having been founded originally on such slight variations. Professor Baird, however, has gone quite fully into a discussion of its merits as a species,|| but the distinctions he particularly mentions as separating it from *P. lotor* — the more tapering form of the tail, the rings of which he deems “narrower and better defined,” with “the light intervals wider,” and a “nearly constant difference in the color of the upper surface of the hind feet,” which he says is darker in *P. Hernandezii* — are so slight, and based withal on characters so exceedingly liable to variation, that they can scarcely be considered as of specific value. Though apparently of somewhat larger size the relatively larger and stouter feet claimed by him to distinguish *P. Hernandezii* his measurements seem to scarcely sustain. He admits that *P. Hernandezii* bears a very close relationship to the *P. lotor*, and says that “without close comparison the differences are perhaps intangible,” and that “its characteristics are more comparative than absolute.” Still “an examination of a large number of North American raccoons,” he affirms, “has resulted in the appreciation of certain differences which appear quite constant.” They are those above specified, and, as I have already ob-

\* Charlesworth's Mag. Nat. Hist., Vol. I, 1837, p. 580.

† Ann. and Mag. Nat. Hist., Vol. X, 1842, p. 267.

‡ In his recent revision of the “Ursine Animals,” Dr. Gray has referred both these to the *P. lotor*. See Proc. Lond. Zool. Soc., 1864, p. 684.

§ Isis, XXIV, 1831, p. 514.

|| See N. Am. Mam., p. 213, and Mex. Bound. Survey, Vol. II, Mammals, p. 22.

served, are very slight, and pertain to the most variable parts of the animal. Some of them I feel sure are but individual differences, depending mainly, especially those in respect to the form of the tail, on age or season. In respect to the black annuli, hardly two specimens can be found that do not vary more or less. In the large series of New England specimens in the Museum of Comparative Zoölogy, the variation between the extremes in this respect covers the whole range of the differences assumed to distinguish the two supposed species. The single authentic specimen of *P. Hernandezii*, labelled apparently by Professor Baird himself, that I have seen\* is not appreciably different in general color from many Massachusetts specimens. The supposed differences, it seems to me, are hence reduced to the single one of absolute size, which a large number of specimens of the so-called *P. Hernandezii*, from different localities, might very considerably modify. From a comparison of authorities, as will be seen from the remarks that follow, this seems to be indeed the fact. The example of *P. Hernandezii* above referred to (No. 67, Smithsonian Cat.), from Bolega, California, is actually smaller than the average of New England specimens.

Professor Baird remarks that some of the characters of *P. Hernandezii* given by Wagler and Wiegmann, as the prevailing color of the back and sides, differed from specimens he referred to it; in other words, they were more like his *P. lotor*. St. Hilaire, in the Zoology of the Voyage of the Venus,† also described and figured a specimen from Mazatlan that varied similarly from *P. Hernandezii* Baird, it being smaller and colored more like *P. lotor*. Under *Procyon Hernandezii* var. *mexicana*, Baird describes a single skin brought by the Boundary Commissioners from Espia, Sonora, that he says agrees with St. Hilaire's Mazatlan specimen (already referred to), which St. Hilaire considered to differ in nothing but in intensity of color from the common *P. lotor*. Professor Baird remarks that this Espia specimen exhibits a close relationship to *P. lotor*, though readily distinguishable from it, he claims, by its "larger and more naked feet and hands." These specimens, in resembling *P. lotor* more than some others from the same region referred to *P. Hernandezii*, show still more fully the inconstancy of some of the characters on which the latter is founded. In habits the two supposed species have not been found to differ.‡ Hence, unless the more southern *P. cancrivorus* occurs in Cali-

\* Contained in the Museum of the Boston Society of Natural History, and received from the Smithsonian Institution.

† Vol. I, 1855, p. 25, pl. VI.

‡ Professor Baird observes: "According to Dr. Berlandier, the habits of this species [*P. Hernandezii*] are precisely similar to those of the common raccoon." Dr. C. B. Reimerly's notes are also of the same purport. — *Report on the Mammals of the United States and Mexican Boundary Survey*, p. 22.

fornia, as supposed by Audubon and Bachman. I see no reason why, in view of the known variability of *P. lotor* in the Eastern States and the relatively small differences only thus far pointed out between them and their Western relatives, all the raccoons of the United States thus far known should not be referred to *P. lotor*.\*

**15. *Ursus arctos* LINNÆUS.** (*U. americanus* Pallas.) **BLACK BEAR.** Extinct in the more thickly settled parts of the State; occasional among the mountains of the western counties.

In respect to the occurrence of this species in this State, Dr. Emmons remarked in 1840: "It is not many years since great numbers appeared there [on the Hoosac Mountain range] at once, and between twenty and thirty were taken in the course of one autumn, on the mountains in Adams and Williamstown. They are still to be found, and several have been taken every year since." (Rep., p. 24.) The local newspapers yet frequently chronicle their capture in Berkshire County.

Contrary to what was formerly supposed, bears everywhere appear to be among the most variable of mammiferous animals, not only in coloration, but in size, proportions, and in the conformation of the skull and other parts of the skeleton. Those familiar with them in life say it is rare to find two alike. A writer in the *American Naturalist*† has alluded to two females of the same litter, captured by him in Maine when young and raised as pets, that differed so essentially in their general build as to correspond respectively with what has been termed "ranger bear" and "hog bear," they differing also as much in disposition as in form. I am also informed by my friend Mr. C. W. Bennett that he has known two cubs of the same litter, taken in one of the Western States, that as they grew up differed very materially from each other in color, one being *black* and the other *brown*. They differed also widely in form and disposition, one being docile and playful while the other was ferocious and dangerous. The leading varieties in color of the American and European bears, as the brown and the

\* This is also the view now taken by Dr. Gray, who remarks respecting *P. lotor* as follows: "This species varies rather in the tint of its colors in the different parts of North America. It is very apt to become white, and is thus the *Procyon nireus* (Gray, Mag. Nat. Hist., 1857, p. 550) from Texas; I described a specimen from California, with the tail imperfect, as *P. psora* (Ann. and Mag. Nat. Hist., 1842); and Wiegmann described two other varieties under the names of *P. brachyurus* and *P. obscurus* (Arch. III, 269). Dr. Baird, in the *Mammals of North America*, considers *P. Hernandezii* as a species, and calls it the Black-footed Procyon, including *P. psora*, which has feet as *pale or paler* than *P. lotor*." — *Proc. Lond. Zool. Soc.*, 1864.

† Vol. I, p. 657.

black bears are now generally deemed to be but varieties and not species, though so regarded by Cuvier and the earlier naturalists generally. Great variations in the form of the skull in individuals from the same locality not infrequently occur, aside from the differences caused by age and sex. Professor Baird mentions a skull from Saranac Lake, New York, which differs very appreciably from the ordinary type, agreeing quite nearly in some respects with the *Ursus arctos* of Europe. Concerning this specimen he remarks: "A large number of specimens from this locality may perhaps furnish a clew to this remarkable variation, which, under other circumstances, would be readily allowed as indicating a distinct species."\* I some time since began to consider many of the so-called specific characters drawn from the skull as of very doubtful value, from the wide range of variation any considerable series of specimens from the same locality, and unquestionably of the same species, usually exhibit, aside from those arising from differences of age and sex. In the foxes and wolves, the common bear, the different species of *Mustelide*, and the larger rodents, such differences are often very considerable. On this point I find the following concurrent testimony from an author little liable to the charge of conservatism in respect to the multiplication of species or other groups.

Dr. J. E. Gray, of the British Museum, in his recent monograph of the bears, in the Proceedings of the London Zoölogical Society, † thus calls attention to the subject. "The examination of the series of skulls of bears in the [British] Museum, like the examination of the series of bones of the *Viverride*, has strongly impressed me with the uncertainty that must always attend the determination of fossil bones, or indeed of bones of all animals, when we have only the skulls or other bones to compare with each other. There can be no doubt that the study and comparison of the bones of the different species is very important, — that the skull and teeth afford some of the best characters for the distinction of genera and species; but few zoölogists and palæontologists have made sufficient allowance for the variations that the bones of the same species assume. In the bears, I have observed that there is often more difference in skulls of bears of the same species from the same locality than between the skulls of two undoubted species from very different habitats and with very different habits. Thus I have the skulls of some bears the habitat of which is not certainly known, which I have doubts whether they should be referred to the Thibet Bear (*U. torquatus*), or to the North American species (*U. americanus*), but I have referred them to the latter, as they were said to have come from that country. It is the same with regard to the skull of a bear that lived in the Zoölogical Gardens for years, which has the general form of the skull and the wide palate of the European bear, but the long last grinder

\* N. Am. Mam., p. 227.

† 1864, p. 684.

and some other characters of the *U. ferox*. This similarity of skulls," he says, "is the more remarkable, as no two bears can be more distinct from each other than the species above named,\* which have such similar skulls, showing that similar skulls do not always imply very nearly allied or doubtfully distinct species."

The bears have ever been a perplexing group, and accordingly the opinions advanced by different authors respecting the number of species vary widely. Several high authorities consider the land bears of Northern North America, Northern Asia, and Europe as forming but one, or at most two, species, among which are Blainville and Middendorff, the latter of whom, with access to a large amount of material, has especially and most minutely investigated the subject. Other authors are disposed to allow a much greater number. But, unfortunately, their statements in reference to the differences that should distinguish them are frequently contradictory. Dr. Gray recognizes eight† in his recent monograph, with numerous "varieties" and "subvarieties" of each. Of the *Ursus arctos*, or brown bear of Europe, he describes four varieties, and of the first of these eight subvarieties, to all of which he gives distinctive names. All of these are chiefly based on variations in color, the teeth, or the skull, although he states in the same paper that characters based on the latter are to a considerable extent unreliable for even the determination of species. ‡ Nilsson, in his Scandinavian Fauna, distinguishes six varieties that differ widely in color from Sweden alone. A careful study of Middendorff's tables of measurements, embracing some fifty specimens of bears from Europe and Asia, show how very extended is the range of variation in osteological and external characters, and how irregular is its nature. Schrenck has also called attention to the great variation in the size of the tuberculated grinders in the bears of Northern Asia,—a character which is unfortunately made the principal basis of Dr. Gray's specific and sub-specific distinctions. Dr. Gray himself mentions that there are considerable variations in the series of skulls of American bears in the British Museum; particularly in the amount of depression in front of the orbits. His several tables of measurements of skulls that he himself refers to one

\* In respect to this point I shall soon show that naturalists high in authority do not agree with Dr. Gray in regard to the great distinctness claimed by him for these species.

† It seems to me that no recent writer has been guilty of greater inconsistency than is exhibited by the author of the monograph on the *Ursidae* above cited; for after calling attention to the variability of craniological characters, and their consequent unreliability as specific distinctions, he adopts some of those that can be readily shown to be the most trivial—even manifestly so from his own paper—as the basis of his classification of his species and varieties. So difficult is it apparently to overcome long-established habits of thought and modes of reasoning.

‡ See preceding page.



species indicate very considerable differences in the proportion of breadth to length in the entire skull, and in the relative length and slenderness of the muzzle. In consequence of such variations Dr. Gray and Professor Baird arrive at widely different conclusions in reference to the relationship of the *U. cinereus* Gray (*U. horribilis* Baird) to the *U. americanus*.

There is a strong tendency among naturalists to consider the Old World bears as all distinct from those of North America, and to recognize at least two species among the latter, — the grizzly bear (*Ursus horribilis*) of the West, and the continentally dispersed black and brown bears (*U. americanus*). Professor Baird, in his Mammals of North America, gives the probable number as five, four of which he seems to consider well founded, and thinks that there may be two others. But each of the recognized species presents so many varieties, which to a greater or less extent intergrade, that well-marked lines of distinction cannot at present be drawn. This has led a recent writer to observe, and it seems to me very justly, "If the same consolidation of species which some authors practise in plants was carried out in animals, we should have but one species [of bear] for the whole northern hemisphere." \*

The present indications are that the *U. horribilis* is hardly so distinct from the common *U. americanus* as has been currently supposed; † it also presents close affinities in many respects with the *U. arctos* of Europe. Towards the north it shades into what is called the Barren Ground bear, which latter has been repeatedly referred, with more or less positiveness, by different authors to the *U. arctos* rather than to *U. americanus* or *U. horribilis*. Middendorff found the bears of Northeastern Asia equalling in size and generally resembling in other characters the *U. horribilis* (*ferox* of authors) of the Western Coast of America. The *U. americanus* also presents numerous variations in color and in other points quite parallel with similar variations in the European *U. arctos*. ‡ Specimens often occur on the one continent that are strikingly like others from the other. Middendorff expressly states that the differences between *U. arctos* and *U. ferox* (*horribilis*) are not greater than occur between different specimens of *U. arctos*. Dr. Gray admits that it is only a knowledge of the locality that in some cases enables him to separate them.

\* Andrew Murry, Geog. Distr. of Mammals, p. 119.

† See Professor Baird's N. Am. Mam., pp. 219 – 228.

‡ I learn from Mr. W. H. Dall, who has recently returned from a three years' exploration of Alaska, bringing with him important information relative to the natural history, geography, etc., of that country, that three kinds of bears are distinguished there; the larger and the more common being the grizzly, the second the so-called Barren Ground bear, while the third and smallest is a black bear; showing that there is found the usual variety, in point of size and color, seen on the Pacific Coast farther south.

In the Natural History Reports of the United States and Mexican Boundary Survey,\* Professor Baird gives much valuable information, in addition to that contained in his Mammals of North America, respecting the bears of the Rocky Mountain and West Coast regions of the Continent. On the whole it tends to render the subject still more difficult and complex, if we recognize more than a single species in North America, as many of the different specimens described represent intermediate stages between the two commonly recognized American species. A specimen collected by Dr. Kennerly, at Los Nogales, Sonora, and others at the copper mines in New Mexico, by Mr. H. J. Clark, differ so much from the "grizzlies" of California, that Professor Baird described them as a distinct variety of the latter, — *Ursus horribilis*, var. *horricus*. Although the leading characters are the same, this "variety" differs in being smaller, with relatively shorter ears and a longer tail, these parts being nearly equal, instead of the ears twice the length of the tail, as in California specimens; it also differs in the texture of the fur, in the arrangement of the colors, in the greater relative breadth of the skull, its narrower and slenderer muzzle and more vaulted palate, and in the shape of the teeth. While the "*horricus*" specimens are quite distinct from either of the so-called varieties of *U. americanus*, the variation from the typical *U. horribilis* of California is towards *U. americanus*; *U. americanus* of the Eastern States differing from them chiefly in being smaller. In the smaller size, compared with *U. horribilis*, and the great breadth of the head, "*horricus*" also affiliates with the *U. arctos*. The latter is usually supposed to never attain the size exhibited by many specimens of the *U. ferox* (*horribilis*); but Prince Maximilian says that this is incorrect, as he has seen Russian bears that were fully as large as the latter; and Middendorff, as already stated, remarks that the bears of Northeastern Asia are as large as those of the Pacific coast of America.†

In reference to the peculiar bears of the Sonoran region, Dr. Kennerly has observed as follows: "In regard to the bears that are found along the northern frontier of Mexico and the southern portion of New Mexico, there seems to be some confusion. In addition to the common black bear,

\* Vol. II, Mammals, pp. 24–81.

† The facility with which the bears can cross in winter from one continent to the other by way of Behring's Strait, and the known fact that they do thus cross (I am assured of this fact by Mr. Dall), renders the close mutual resemblance of the bears of Northeastern Asia and Northwestern America a matter of no great surprise. The similar resemblance between the martens and the representatives of the other circumpolar species from these countries, which has been already pointed out, though some of them may be able to pass less readily than the bears from one continent to the other, would seem to be fully accounted for by a similar occasional migration, if any hypothetical explanation for so natural a phenomenon as the great similarity of the animals specifically identical in these slightly separated districts is required.

*Ursus americanus*, and the large Grizzly, *U. ferox*, there is found another, intermediate in size to these, generally of a brownish color, with the tips of the hairs often silvered, especially in the old individuals, and in appearance, except in size, is almost identical with the *U. ferox* found in such great numbers in California. Among the people of the country they are known as *brown bears*; but this term is variously modified by the most experienced hunters, as we have heard applied by them, to the same individual, the name grizzly bear, touch of the grizzly, cross between the grizzly and brown bear, and common brown bear; but on no occasion have we heard them assign any relationship between these animals and the common black bear, causing us to believe that there must be a considerable difference between this animal and the brown bear of Oregon, which is called by naturalists only a variety of the black; in fact, its size generally, would necessarily preclude such comparison, while even the very old individual falls far short of the weight and dimensions of the *U. ferox* of California, of which we could much more easily consider it a variety than of the *U. americanus*.\* One of the three of Mr. H. J. Clark's specimens, however, referred by Professor Baird to the *U. cinnamomeus* Baird, was "glossy black," and the others brown.

Audubon remarks that the *U. horribilis* varies in color from nearly white through various shades of pale and dark brown to black, it being difficult to find two specimens alike. The young are generally much darker than the adult. Yellowish gray and grayish brown are common varieties, while some are of a rufous tint. This account is confirmed by Prince Maximilian's observations on the bears of the Upper Missouri.†

The specimens from New Mexico and the adjoining country southwards, which present the peculiar characters mentioned above, have usually been referred to the *U. horribilis*, as previously stated; but others that are equally perplexing, but commonly referred to the brown variety of *U. americanus*, also occur in the same region. Some of these latter differ so much from other brown bears from Oregon, also referred to *U. americanus*, that Professor Baird has considered the probability of their proving distinct species very great, and proposed to call the former, in that event, *U. amblyceps*. These Sonoran specimens differ from representatives of *U. americanus* from the Eastern States in nearly the manner that the Sonoran variety *horricus* of the grizzly, *U. horribilis*, does from the true *U. horribilis* of California; namely, in the greater relative breadth of the head, the relatively smaller size of the molar teeth, and the irregular character of the

\* United States and Mexican Bound. Surveys, Vol. II, Mammals, p. 28.

† Verzeichniss der auf seiner Reise in Nordamerika beobachteten Säugethiere, Vom Prinzen Maximilian zu Wied. Archiv für Naturgeschichte, XXVII, 1861, Theil 1, p. 203, Taf. VIII.

coloration. Professor Baird provisionally refers them to the *Ursus americanus*, var. *cinnamomeus*, of Audubon and Bachman, to which, he says, they bear the nearest resemblance.

Prince Maximilian, in his memoir "Über die Selbständigkeit der species des *Ursus ferox* Desm.,"\* urges strongly the distinctness of *U. horribilis* (*ferox* Maxim.) from both *U. americanus* and *U. arctos*, in which he is supported by the anatomical observations of Dr. C. Mayer, which form an appendix to his paper. Several specimens of the former, of different ages, from the Upper Missouri, are described in detail, but no differences other than those previously pointed out by other authors, are mentioned. They consider that the shorter ears and longer claws of *U. horribilis*, with certain minor osteological peculiarities, sufficiently distinguish it from *U. arctos*. These authors admit that bears from northern countries present great individual differences; yet, in reviewing Middendorff's arguments, they offset their conclusions, based on an examination of a very limited number of specimens, against those of the latter, formed from probably as careful an elaboration of many times their amount of material. The differences that have been described by authors as occurring between specimens of *U. arctos* from different parts of Europe and Asiatic Russia, or between different specimens of either *U. horribilis* or *U. americanus* from different localities on this continent, are as great as those they urge as peculiar to their so-called species.

I have not space to notice in detail each point urged as distinctive by those authors who divide the bears into a large number of species. As they mainly rest on the shape and size of the molar teeth, the relative length of the claws and the ears, and the proportions of the skull, a few further remarks on these characters may not be out of place. In Professor Baird's table of measurements of skulls of American bears, the average proportion of breadth to length in the seven specimens cited is sixty per cent, with a minimum of fifty-five per cent, and a maximum of seventy-one. Only one of the series, however, exceeds sixty. Adding four other specimens referred by Baird to "*cinnamomeus*?" the average of the eleven is fifty-nine and a half per cent; the minimum is fifty-three, and two specimens range above sixty. The proportional breadth of the skull in eight specimens of *U. horribilis* is fifty-six per cent. Between the extremes of this series (Nos. 1218 and 2037) the variation amounts to ten per cent. In his comparison of *U. horribilis* with *U. arctos*, Baird cites two of Blainville's specimens in which the same proportion is sixty-six per cent; in reference to which he adds: "This width of head far exceeding that of any well-known American species, would appear to be quite conclusive as to identity,"—Professor

\* Verhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Akademie der Naturforschung, Band. XXVI, erste Abtheil., 1857, pp. 33–85, Taf. III, IV, and V.

Baird not having then received the Saranac (New York) specimen, with the breadth of the head seventy-one per cent of the length. In five skulls of the *U. arctos*, of which measurements are given by Dr. Gray, the average proportion of breadth to length is sixty-seven per cent; in five of the *U. "torquatus,"* sixty-one; in two of *U. "syriacus,"* sixty; in four of *U. "Isabellinus,"* sixty. The average of these sixteen European and Asiatic skulls is thus sixty-two per cent. Gray also gives measurements of five American skulls; viz., two of *U. cinereus* (= *U. horribilis* Ord) and three of *U. "americanus";* the proportional breadth of the skull in the latter is sixty-one per cent, and in the former fifty-eight. This would seem to indicate a tolerable constancy in the greater narrowness of the skull in the American bears. But from Middendorff's table of measurements of fifty-five skulls, from different parts of Russia (chiefly from Northeastern Asia), the percentage of breadth to length falls to fifty-eight and a quarter, and is hence almost precisely that of the American. The maximum breadth of skull seems to be reached in Western Europe; thence eastward to Kamschatka there is a nearer and nearer approximation in this character, as in general appearance, to the American animal.

In respect to the variability of the skull in other particulars, Dr. Gray, in referring to two skulls of *U. horribilis*, remarks that they differ very considerably; the one is much broader, with the palate wider, the nose shorter, and the orbits higher and rounder.

In comparing the teeth of the American bears with those of the European, when but a single example of each is taken, the differences *may* be considerable, so great, indeed, that if constant they might be regarded as sufficient to decide the question of the distinctness of the species; but since specimens frequently occur from the same locality that differ as much, and others from the different continents that are almost or quite indistinguishable, the unreliability of such distinctions becomes sufficiently apparent.

Variation in the size and shape of the molar teeth are found in other groups than the bears, though rarely perhaps so great. According to Professor Peters of Berlin, in the *Otarie*, or eared Seals, the variation in this respect seems to be even somewhat greater. Most authors have heretofore looked upon the teeth of the *Otarie* as affording good generic characters, but Professor Peters has found them to be so exceedingly variable that he does not consider them reliable for even specific distinctions.\*

The ears, in length and form, are found to vary greatly in specimens of *U. horribilis* from different localities, especially from points on different sides of the Rocky Mountains; whether variations of this sort are found in *U. arctos*, it is difficult from the few sufficiently detailed measurements given by authors to determine. That such do occur in specimens of bears referred

\* Monatsber. Ak. Wiss., Berlin, 1866, pp. 261-281 and 655-672.



to the same species by authors who separate them into numerous species, lessens the importance of distinctions based on them as separating the bears of America from those of the Old World.

The claws are well known to vary in length at localities not very remote, in the Old World and in the New. Although the differences between specimens of *U. horribilis*, which seem to have them ordinarily the most developed, and others of *U. arctos* from Western Europe, is very great, they do not appear to have the importance as specific characters assigned them by Prince Maximilian and Dr. Mayer.

Finally, in weighing the evidence in reference to the number of species of North American bears and their relationship to those of the Old World, it is evident that the comparatively small number of specimens thus far examined, either from a single region or in altogether, and the vast areas from which no specimens have been received, should be carefully considered as showing how few the data are on which any opinion must be based. The inconstancy of character presented by those from the same locality, especially in the breadth and other proportions of the skull, in the shape and relative size of the molar teeth, in color, and in size, should also be duly considered, as well as the fact that however wide the differences between specimens from distant localities are, those from intermediate ones are generally of an intermediate character. In some districts bears find an abundant supply of animal food, while in others they are more or less restricted to a vegetable diet, and that these differences must give rise to modifications in the teeth and bones of the skull is to be expected. From the wide geographical range of even the different restricted so-called species, their representatives are subjected to widely different climatic and other modifying influences. In America, the coincidence of the greatest number of individuals with the maximum development in size seen in the region occupied by the typical *U. horribilis*, as in California, and the gradual transition in the easterly portions of the Rocky Mountain district to aberrant forms of this type, some of which indisputably approach quite near the common style of *U. "americanus"* of the eastern portions of the United States, and at the extreme north of the continent to the *U. arctos* of the Old World, especially to the Russian type of that animal, are facts which render the separation of the bears of these several regions into well-defined species quite improbable, if not impossible. I hence see no alternative but to consider with Blainville, Middendorf, and Murry, all the bears of the Northern Hemisphere, excepting *Ursus maritimus*, as forming but a single species. Here, as in other similar cases already considered in this paper, if the opposite view be adopted, it appears inevitable that still other species than those authors have already recognized must be allowed, with numerous "sub-species," or "varieties" and "sub-varieties" of each, in order to dispose of the constantly occurring intermediate forms.

## PHOCIDÆ.

16. **Phoca vitulina** LINN. (*Callocephalus vitulinus* F. Cuv.)  
COMMON HARBOR SEAL. Abundant. I have observed it to be particularly numerous about Ipswich, as many as eight or ten being sometimes seen at once. In June the females are accompanied by their young, then apparently about one fourth grown. Though so common, their habits seem to be little known. They are rarely captured, as when killed they sink to the bottom and are thus difficult to obtain. A fine nearly adult male, now in the Museum of Comparative Zoölogy, was obtained at Wellfleet, in June, 1868, by Mr. C. J. Maynard and the writer. The specimen having been stranded, it had just died of exhaustion when discovered, from its frantic efforts to regain the water. It had repeatedly floundered several yards up the steep sand beach.

In reply to inquiries of mine respecting our seals, Captain N. E. Atwood, of Provincetown, has kindly written me respecting this species as follows: "At Provincetown we occasionally see a straggling specimen of what we call the Harbor Seal; in the vicinity of Cape Cod it is not very common; but there are localities on our New England coast where, in summer, they are found in great numbers. In Boston Harbor, west of Rainsford Island, there is a shoal-water bay of considerable extent, in which is a small ledge of rocks that at low water rise several feet above the surface; on these rocks many hundreds of these seals may be seen at any time during the summer. If the ledge is approached, they all dive into the water and rapidly disperse, but soon return again if they perceive no danger. These seals are small, and of little value, and are hence unmolested."

17. **Cystophora cristata** NILSSON. HOODED SEAL. From accounts I have received from residents along the coast of a seal of very large size observed by them, and occasionally captured, I am led to think this species is not of very unfrequent occurrence on the Massachusetts coast. Mr. C. W. Bennett informs me of one taken some years since in the Providence River, a few miles below Providence, which he saw shortly after. From his very particular account of it I cannot doubt that it was of this species. Mr. C. J. Maynard also in-

forms me that a number of specimens have been taken at Ipswich within the past few years, that have weighed from seven hundred to nine hundred pounds. It seems to be most frequent in winter, when it apparently migrates from the north.

### CERVIDÆ.

18. **Cariacus virginianus** GRAY. (*Cervus virginianus* Boddært.) VIRGINIA DEER. A few still exist in Plymouth, Barnstable, and Berkshire Counties, where they have been for some time stringently protected by law. Mr. Samuels, in the report of the State Board of Agriculture of Massachusetts for 1861 (p. 189), observes: "This beautiful animal is now rare in this State, and will soon, probably, be extinct; it is found in the woods in Plymouth and Barnstable Counties, in the neighborhood of the Hoosac Mountains, and on several of the islands on the southeast coast." It has for a long time been extinct in most parts of the State. They were last seen in the vicinity of Springfield about fifty years ago.

Respecting individual variation in species of the *Cervidæ*, and especially in *Cervus* (*Cariacus*) *virginianus*, I find the following important observations by Hon. John D. Caton, in the Transactions of the Ottawa Academy of Natural Sciences.\* Referring to our standard works on the American *Cervidæ*, he observes: "The superficial marks which assign to each of these species its appropriate classification are properly described. Yet this description is generally from a single specimen, while in fact individuals differ very widely, both in color and form; so much so that even among the few I have in my parks we might almost persuade ourselves we have distinct varieties. Among the fifty or sixty deer which I have, there are three distinct shades of color, which also seem to be characterized by a peculiarity of form. The lightest colored have long legs and slim bodies; they have the largest horns, do not fatten readily, and are more wild and restless than the others. The next are of a considerably darker shade; in some instances quite black along the top of the neck and down the back, and a black tail, as distinctly so as the California deer; they have frequently other black marks. I have one specimen with a distinct black line over each eye, of a triangular form, passing towards the ear; and several others in which this mark is quite visible, though not so conspicuous, giving them rather a ferocious appearance. This variety has short legs, rather short, heavy bodies, are very tame, and always the fattest in the park. The smallest variety, both in

\* Part I, 1868, p. 43.

size and numbers, is of a distinct russet color, and has less white under the throat and belly than either of the former. In one specimen the white is nearly wanting beneath the lower jaw, and there is very little under the neck. They are not so wild as the first class mentioned, but are more timid than the second, and, in their disposition to fatten, seem also to be intermediate between the other two."

In regard to the Elk he also observes: "There seem to be distinct classes of the elk, which are as manifestly hereditary as those of the deer, especially so as to form and size. Of these I recognize in my parks two classes, varying in form and size, but not materially in color. . . . One variety is larger, and has longer legs, and is much more graceful in form and carriage than the other. The largest variety seems to be the most hardy, and fattens the most readily; it is also less vicious."

The Elk or Wapati (*Cervus canadensis* Erxl.), judging from what is known of its former distribution, undoubtedly once inhabited Massachusetts. According to Professor Baird and others, it is still found in the Alleghanies in Pennsylvania.\*

The Moose (*Alce malchis* Ogilby; *Cervus alces* Linn.) also formerly undoubtedly existed in Massachusetts, though it has now been long extinct here. It still occurs in Maine, as far south as the Umbagog Lakes, whence specimens have been received at the Museum of Comparative Zoölogy.

As to whether the individuals found in America are identical with those of the Old World, there is at present some discrepancy of opinion, though formerly regarded as the same. The distinctions between them are very slight, and to what extent constant is hardly known. While the Moose of Asia and Europe are considered identical, Sir John Richardson has pointed out some slight differences in the skeleton of those of the New and the Old World, which incline him to the opinion that they may be distinct species, and as such he bestowed on the American the specific name of *musca*. Whether these distinctions are more than individual, or such as would disappear in a large series of specimens, it is perhaps impossible to say. Their distribution, however, is remarkably alike, reaching the Arctic coast on both continents, and extending southwards to about the same isotherm; on the whole I consider their identity as extremely probable, if not absolutely certain.

\* Audubon states that fifty years ago a few still lived in Kentucky, near the Ohio River, and that they were not very uncommon at that time in Southern Illinois, — localities much more southern than Massachusetts. — *Quadr. N. Am.*, Vol. II, p. 88.

The Woodland Caribou, or Reindeer (*Turandus rangifer* Gray; *Rangifer caribou* Aud. and Bach.), like the preceding, probably once inhabited Western Massachusetts, judging from what is known of their earlier distribution, though probably rather as an occasional visitant from the north than as a numerous or permanent resident. It is still found occasionally in Northern Maine, whence specimens have been received on several occasions at the Museum of Comparative Zoölogy, from Mr. J. G. Rich. In March, 1863, according to Professor Verrill,\* this gentleman brought seven to Boston, killed on the head waters of the Kennebec, out of a herd of about twenty, supposed by Mr. Rich to have come from regions farther north, as the caribou had been noticed there by him but once before during the previous five years. It is said to occur also in the Adirondacks of New York.†

In this species we are again met by the old question of identity with a closely allied Old World congener. Several high authorities still maintain its identity with the European and Asiatic reindeer, while others, whose opinions are equally entitled to consideration, believe them distinct. Unlike the moose, the reindeer, if forming but a single species, are apparently easily separated into several very distinct races, in some cases differing in size, but chiefly in the character of the horns. In America, the woodland caribou constitutes a southern form, and inhabits the northern wooded districts of the continent; in the Arctic Barren Grounds it is replaced by a much smaller race, but which, it is said, has larger horns. This smaller race seems to be a circumpolar one, inhabiting the similar woodless tracts of the extreme north of the Old World, and also Greenland, but differing somewhat in different districts, it is claimed, by peculiar modes of branching of the horns, especially in respect to the form of the brow antlers. Whether these differences that have been pointed out are to be considered as constantly characterizing the reindeer of these different regions is still questionable, as but comparatively few specimens appear to have been yet compared. From the great variability in the branching of the horns presented by all the different species of the *Cervidae*, the right and left horns in the same individual, as well as the successive sets, being often most notably unlike, it seems to be a distinction of doubtful value.

In reference to the disputed question of whether there are one or several

\* Proc. Bost. Soc. Nat. Hist., Vol. IX, p. 226.

† In reference to the much farther extension southward of the habitat of this species in earlier times than even two centuries ago, see the general remarks on the geographical distribution of the Massachusetts Mammals, at the close of the paper.



species of reindeer, Mr. Andrew Murray, in his valuable work on the Geographical Distribution of Mammals (p. 151), observes: "But there are several varieties; how far some of these deserve to be reckoned species, and if so, which of them, is a more difficult question. There is, first, the fossil variety; next, the Lapland reindeer, which is nearest to the fossil type; then the Siberian, which, although very close to the Lapland, differs in the character of the horns; moreover, there are two varieties in North America, and one in Greenland and Spitzbergen. I believe all these to be altered forms developed out of one stock, modified to an extent corresponding with the degree of deviation of their respective climates from the original condition of existence of that stock." Mr. Murray gives figures, copied from various authors, of the antlers of these different varieties, and mentions in detail their points of difference and resemblance; concerning which he adds: "The resemblance between them is too constant, and, as will be seen by the figures, is too considerable to be a matter of accident or coincidence."

Dr. Richardson seems to have first clearly distinguished the two varieties of American reindeer, or caribou, now so generally recognized, but of the woodland variety (" *Cervus tarandus*, var. *β sylvestris* ") he claims to "know little, having," he says, "seen few of them alive or in an entire state. It is," he adds, "much larger than the Barren Ground caribou, has smaller horns, and when in good condition is vastly inferior as an article of food." The Barren Ground variety he seems to have studied with great care. Respecting the character of the horns, the peculiar form of which seems to be the chief character yet discovered by which to distinguish the different so-called varieties, he observes: "The old males have, in general, the largest and most palmated horns, while the young ones have them less branched, and more cylindrical and pointed; but this is not uniformly the case, and the variety of forms assumed by the horns of the caribou is, indeed, so great, that it is difficult to comprehend them all in a general description. Some have the branches and extremities *broadly palmated* [the italicizing is my own], and set round with finger-like points; others have them *cylindrical, and even tapering, without any palmated portion whatever*. The majority of adult males have a brow antler, in form of a broad vertical plate, running down betwixt the eyes, and hanging over the nose. In some, this horn springs from the *right* horn, in others from the *left*; in many there is a plate from *each side*, and in a considerable number it is *altogether wanting*: the plate is, in general, widest at its extremity, and is set with four or five points, which are sometimes recurved. The *main stem* of the horn also exhibits an *endless variety* in its *thickness, altitude, and curvature*." Major Smith observes, that a "probable distinction, by which some, if not all, of the varieties of caribou may be distinguished from the reindeer of the

Old Continent, is, that their horns are always shorter, less concave, more robust, the palm narrower, and with fewer processes than those of the former," — a view that has been adopted by other writers. Respecting this assumption Dr. Richardson thus observes: "I can with confidence say, after having seen *many thousands* of the Barren Ground kind, that the horns of the old males are as much, if not more, palmated than any antlers of the European reindeer to be found in the British Museum." If attention is given to the parts of the above quotation from Dr. Richardson that I have *italicized*, it will be seen how unreliable must be any distinctions based on the horns, unless the comparisons are more extended than they thus far seem to have been. That the horns of the Barren Ground form may differ from those of the wooded districts in other points than size is quite possible, but in the several pairs of horns of the latter in the Museum of Comparative Zoölogy there is a very close resemblance to those of the Barren Ground and Greenland caribous figured by Baird and Richardson, the Northern Maine specimens much more nearly agreeing with these than with Professor Baird's figures of the Lake Superior one (No. 900), which is evidently an extreme form. The horns of the northern or Barren Ground race of the American reindeer, according to the best authorities, do not differ essentially from those of the reindeer of the corresponding districts of the Old World. Mr. Murray quotes Mr. Alfred Newton as saying, in reference to the reindeer he saw in Spitzbergen: "The average type of a good Spitzbergen head is very well represented by the first figure in the Fauna-Boreali Americana (Vol. I, p. 240) of the so-called Barren Ground caribou (*Cercus tarandus*, var. *arcticus* Richardson)"; which testimony of Mr. Newton, he states, is supported by that of Mr. Lamont.\* Mr. Newton, however, says the Spitzbergen reindeer are "certainly smaller than the Lapland reindeer."

Professor Baird observes, respecting the American woodland race, that its relationship to the European reindeer is not well ascertained. "The opinion," he says, "is gaining ground that the Barren Ground reindeer is distinct, and as this species cuts it off from the Arctic Circle, it would seem most probable that it cannot be the same with the animal inhabiting the circumpolar region of the Old World." But the recorded observations seem fully to prove, as is now, indeed, currently admitted, the existence of two similar races on the Old Continent, — a northern and a southern, differing from each other nearly as do the Barren Ground and woodland varieties in North America. Hence if we allow two species of reindeer for America, why not two for the Old World? But there, where the species has been longer and is better known, competent authorities seem not to doubt their identity, and from which some even regard the American as

\* Geog. Distr. of Mam., p. 155.

inseparable. I have already shown that the characters used for their separation are by no means reliable. Concerning the Greenland reindeer, Mr. Robert Brown, in a recent valuable paper on the Mammals of Greenland,\* says, "that after very excellent opportunities of comparison and study," he considers "the Greenland reindeer only a climatic variety of the European species. I have, moreover," he adds, "seen specimens of reindeer horns from Greenland, which could not be distinguished from European, and *vice versa*. On the whole, however, there is a slight variation."

As I have previously remarked, I see no good reason why all may not be considered as one species, within which may be distinguished several quite well-marked geographical races.

In relation to other facts, the differences in size presented by the two races of American reindeer, the woodland and the Barren Ground, becomes extremely interesting; for, supposing them to form one species, as there seems to be little reason to doubt, the variation in this respect is directly the reverse of that ordinarily presented by individuals of the same species from localities differing considerably in latitude: the general law being an increase in size at the northward. But here there is a marked decrease. It is yet not quite exceptional, as a point is reached in the habitat of the non-migratory circumpolar species, where the rigor of the climate, and the consequent altered conditions of life, seem unfavorable to a maximum development of the animal. This is exemplified by the small stature attained by the circumpolar tribes of men, as the Esquimaux of Greenland and of the north of America, and the Laplanders of the Old World. The common wolf (*Canis lupus*) has its smaller northern form, which, in America at least, occupies the Barren Grounds and the region northwards to the Arctic coast, and which differs quite positively from its more southern relatives.†

A smaller circumpolar Arctic form of the fox has long been recognized, differing in color, in size, and in the texture of its fur from the common species (*Vulpes vulgaris* and *V. fulvus* auct.). And there is a well-known corresponding race of bears, commonly referred to the *Ursus arctos*, which in America pass almost insensibly into the more southern and larger *Ursus horribilis*. Whether this decrease in size in the extreme boreal regions

\* Proc. Lond. Zool. Soc., 1868, Part II, p. 352.

† "Of this species (*Canis griseo-albus* Rich.) I consider that there are two varieties, one of which is of a dark color and large size, inhabiting the wooded portions of the [Mackenzie's River] District as far north as the Youcon River. The other is usually of a dirty white tint, with, in general, a dark stripe down the back, and frequents the Barren Grounds northwards to the Arctic coast. It is of smaller size than the first-mentioned variety, and lives in much larger bands; indeed, it may possibly be a distinct species." — B. R. Ross, *Nat. Hist. Rev.*, July, 1862, p. 271.

extends to other species I have not at present the means of determining, though it is hardly to be expected that it will to all, since some of them are to a considerable degree migratory, going southward in winter, as the lynxes, martens, and some others. Hence extremes of climate, whether of heat or cold, seem to unfavorably influence the development of animal life generally, a mean or temperate region being as necessary for the highest development of the lower orders of mammalia as for that of man.

Besides the marked climatic modifications in size and in other features in the species cited above, certain other variations in them may be here appropriately referred to. These, though slight, so commonly appear in a number of species inhabiting the same region as to lead one at once to suspect a common cause for such differences. Dr. Richardson\* long since pointed out slight differences in the color and texture of the fur, and in the breadth of the foot, in species which he considered identical in North America and Europe, between their representatives from Northern North America and Central Europe; the former having a finer and thicker coat, and broader feet, to better adapt them to a colder climate and a more snow-covered country, as well as brighter and livelier colors. These modifications appear also, he says, in the native domestic dogs.\*

Naturalists have repeatedly remarked the narrower form of the head in the moose, bear, fox, and wolf in Eastern North American specimens as compared with others from Western Europe. In the former, the absolute breadth of the skull is generally less, while there is at the same time a greater development of the facial portion. In these animals a difference in size has also been claimed to distinguish their representatives from the two continents; but, owing to the variation in size on either continent with the latitude and elevation of the locality at which they were collected, observations on this point are somewhat contradictory. The general indication, however, seems to be that the American somewhat exceed the European when both are from near the same isotherm.

I have already called attention to the fact of the same species varying in color in different portions of its habitat, as in the case of the *Canis lupus*. On both continents, this species gradually changes from nearly white (yellowish or grayish white) in the Arctic regions to very dark or "black" in the southern. Individuals of the black and cross varieties of the fox (*Vulpes vulgaris*) are most numerous on both continents towards the north; † at the south, while the general fulvous color prevails on the dorsal

\* Fauna Boreali-Americana, Vol. I, p. 91.

† Mr. B. R. Ross gives the proportion of the different colors in the foxes killed in the Mackenzie River District as red  $\frac{6}{15}$ ths, cross  $\frac{7}{15}$ ths, silver  $\frac{2}{15}$ ths; or sixty per cent of the dark variety to forty of the red; while as far south as the United States the dark varieties probably scarcely exceed one per cent. — *Nat. Hist. Rev.*, 1862, p. 272.

surface, there is apparently a greater development of dusky on the ventral; this type forming the *Vulpes "melanogaster"* of the south of Europe. According to Professor Baird, the black varieties in some of the American squirrels reach their greatest numerical development in the northern portions of their habitat; \* where also melanic specimens of the marmot and racoon are most frequent. On the Atlantic slope there is a noticeable tendency to a predominance of gray rather than rufous tints, while in the interior, particularly in the Mississippi Valley, and on the Plains, the reverse is the case, in at least a number of species. I have in another place † called attention to the faded appearance of the plumage of many species of birds on the Plains, in those that range across the continent; in others there is a tendency to an increase of fulvous and rufous, as is noticeable in some mammals. In the Sonoran region there is a marked inclination to pied varieties, such occurring in the weasels (*P. frenatus* and *P. xanthogenys*), skunks (*Mephitis bicolor* and also in *M. mephitis*), the bears and squirrels. The changing to white in winter of many species at the north which at the south constantly retain their summer colors, as the weasels, the Arctic fox, ‡ the wolf, and some of the hares, § it seems to me is also to be properly classed in the category of climatic and geographical peculiarities of coloration. The prevalence of neutral mouse-gray tints in so large a proportion of the mammals of Australia, and of plumbeous and black in those of Africa, in contrast with the brighter and more varied colors of those of the other continents, is but a grander exhibition of the same kind. The hibernation of certain species in the cold regions that in the warmer are constantly active, as in the *Ursidae* and *Vespertilionidae*, for example, is in some respects a similar phenomenon.

There are differences in size between specimens of the same species from different localities that are not apparently explainable on the ground of difference in the latitude and altitudes of their respective places of birth. On the Mississippi prairies, for example, some species of *Murida*,

\* North Amer. Mam., p. 244.

† Mem. Bost. Soc. Nat. Hist., Vol. I, p. 513.

‡ Concerning this point Mr. Alfred Newton observes: "I have never seen it remarked, but it is unquestionably the case, that nearly all the Icelandic examples of *Canis lagopus* are 'blue' foxes; that is to say, their winter coat is nearly the same color as their summer coat. This fact, I think, must be taken in connection with the comparatively mild climate which Iceland enjoys in winter; and if so, is analogous to the circumstance that of the Alpine Hare (*Lepus timidus* Linn., non auct.) always becoming white in Scandinavia, generally so in Scotland, but seldom in Ireland." (*Proc. Zool. Society of London*, Dec. 1864, p. 497.) Dr. Richardson also states that the Arctic fox is of a purer white on the shores of Hudson's Bay than at Bhering's Straits, where, as is well known, the climate is considerably milder. (*Faun. Bor. Amer.*, I, p. 87.)



*Talpide*, and *Soricidae* attain an appreciably larger size than under nearly the same latitude and degree of elevation at the eastward. The same fact is also observed in the mink; while the bears of the Pacific slope are larger than from most other parts of the Continent. Whether a greater abundance of their proper food may be the cause of this, it is impossible now to determine. They are facts, however, that are worthy of careful consideration, and they are cited here simply to call to them further attention.

It may be observed, in passing, that allied species, as the fox and wolf, vary differently under the same conditions; melanism being most developed in the one at the south, and in the other at the north. It is also noteworthy that circumpolar species follow the same law in their climatal variations that obtains in the differentiation in both the fauna and flora of the northern hemisphere in passing from the north southwards. As is well known, there are many species of animals and plants at the north, where their habitats approximate, that are common to the two continents. Such species become less and less numerous to the southwards, and beyond the tropics very few occur on both the Eastern and Western continents. In like manner, specimens from towards the north of the two continents of circumpolar species that range over the north temperate regions are much nearer alike than those collected from near their southern limits of distribution.

For the following notes on the Cetaceans of the Massachusetts coast, and their local names, I am indebted, as previously stated, to Captain N. E. Atwood, of Provincetown. For the scientific names I am under obligations to Professor E. D. Cope, of Philadelphia, to whom I forwarded Captain Atwood's notes for the determination of the species. Professor Cope's identifications and remarks are distinguished by being enclosed in brackets.

#### BALÆNIDÆ.

19. [*Balæna cisarctica* COPE.] "RIGHT WHALE. Occasional.

"This well-known species is at times taken here; in former years they were much more frequent in their visits than now. Although a straggling specimen may be seen at any time, they are generally more common during the latter part of April and the early part of May. They yield a larger amount of oil than any other species that visits our coast; besides which they have a large quantity of whalebone that finds a ready market, known as the "black whalebone" of commerce.

The skeleton of the right whale in the Museum of Comparative Zoology was taken here. The specimen yielded eighty barrels of oil, and the bone that was taken from its mouth was sold for \$1,000."

20. [**Agaphelus gibbosus** (Erxl.) COPE.] "SCRAGG WHALE. Rare. A species of whale known by this name, nearly allied to it not identical with the right whale, is sometimes taken here. It is the opinion of many of our whalers that they are not a distinct species, but the young right whale that lost its mother while very young and grew up without parental care, which has caused a slight modification. The most prominent feature is that in its dorsal ridge, near the tail, there are a number of small projections or bunches, having some resemblance to the teeth of a saw. It has no dorsal fin or hump on its back."

21. [**Megaptera osphyia** COPE, or another **Megaptera**.\*] "HUMPBACK WHALE. This species is common on our coast, and sometimes comes into Provincetown harbor, where it is attacked and killed by our whalers. They yield but a small quantity of oil compared with the yield of the right whale, the usual quantity being from ten to fifteen barrels. The bone in its mouth, unlike that of the right whale, is of little value and not considered worth saving. When harpooned it will run with great swiftness, and continues to do so while it is being killed. Its affection for its young seems stronger than that of any other species, as the mother will expose her own life in defence of her offspring."

22. **Eschrichtius robustus** LILLJ. Professor Cope informs me that he has found a jaw of this species on the New Jersey coast; it should in all probability be enumerated in the present list.

23. [**Sibbaldius tectirostris** COPE, and probably another species.] "FINBACK WHALE. Frequent.

"This species is the most common large whale found along our coast, and is frequently seen at all times in the year. They are not har-

\* Professor Cope believes that under the name of "Humpback," of Captain Atwood's list, more than one species may be embraced; and also more than one under the species called "Scragg Whale."

pooned by the whalemén, as they run so swiftly they cannot be killed. I have known a few to be killed by shooting them with a bomb lance. When they have been killed in this way in our bay they always sink to the bottom (they being not a fat whale), and remain there some few days, during which time much of the blubber is eaten off by sharks. I have known two of this species to run on shore in the night, in our harbor, and be left by the receding tide. When they were killed there appeared to be no indications of disease, and the cause of their running on the beach could not be learned. One of them yielded fourteen and the other twenty barrels of oil." In a subsequent communication Captain Atwood adds: "The finback is a species that yields only a small quantity of oil compared with its size; the blubber is thinner than in other species. The right whale killed here, of which the skeleton is in the Museum of Comparative Zoölogy, was forty-seven feet long, and yielded eighty barrels and fourteen gallons of oil; a finback since killed here was fifty-four feet long, and made only twenty barrels of oil, though a good fat whale of its kind."

24. *Sibbaldius tuberosus* CORE. A specimen at first doubtfully referred to the *S. laticeps* Gray,\* by Professor Cope, but since regarded by him as a new species,† was captured in Mobjack Bay, Virginia, in May, 1866. It being a somewhat northern species, it should probably be included in the present list.

25. [*Sibbaldius borealis* FISCH.] "SULPHUR-BOTTOM WHALE. Rare. "This species is said to occur on our coast. Like the finback, it has on its back a very small dorsal fin. Being very much elongated, it is a swift runner, and passes through the water with a velocity so great that the whalemén cannot kill them in the same way that they take the other species. I have never seen it dead, and know but little about it."

26. [? *Balænoptera rostrata*. I have not yet identified this one.] "GRAMPUS. Occasional. When seen here alone, we know it by that name. It is the opinion of some of our whalemén, with whom I have conversed respecting this whale, that it is not a distinct species, but the young of the finback."

\* Proc. Phil. Acad. Nat. Sci., 1866, p. 297.

† *Ibid.*, 1869, p. 16.

## PHYSETERIDÆ.

27. **Physeter macrocephalus** PANDER. SPERM WHALE. Occasional off the coast; formerly much more frequent.

28. [**Mesoplodon sowerbiensis**.] To this species Professor Cope refers a specimen found stranded a short time since on Nantucket Island. I learn from Mr. S. C. Martin that it was called "Grampus" by the whalers, and that its length was sixteen feet and three inches, and girth seven feet. The skull, presented by Mr. Martin to Professor Agassiz, is now in the Museum of Comparative Zoölogy, and is the specimen referred to by Professor Agassiz at the meeting of the Boston Society of Natural History, held November 6, 1867. He remarked that it was a species new to America, and that it belonged to the genus *Mesoplodon*, as characterized by Gervais, and ought to be separated from the fossil *Xiphius*, described by Cuvier.\*

## DELPHINIDÆ.

29. [**Orca gladiator** SUNDEVAL.] "KILLER. This species visits our bay occasionally in small schools. Their dorsal fin is several feet high when fully grown. They are at times, in summer seen coming into our harbor. The horse-mackerel fears them, and will run in shore when they appear."

30. [**Globiocephalus melas** TRAILL. (*D. intermedius* Harlan and *G. intermedius* Gray.)] "BLACKFISH. Common. This well-known species sometimes come into our bay in large schools in summer and autumn. They are then attacked by a number of boats from the shore, and often driven into shoal water or on shore and hundreds killed."

31. **Hyperaodon bidens** OWEN. A specimen referred by Professor Cope to this species came ashore at North Dennis in January, 1869; its skeleton, secured by Mr. J. H. Blake, is now in the Museum

\* Proc. Bost. Soc. Nat. Hist., Vol. XI, p. 318.

of Comparative Zoölogy. A few weeks later Professor Cope obtained another that was stranded near Newport, R. I.

32. [**Beluga canadensis** ERXL. WHITE WHALE.] At the close of his list Captain Atwood thus mentions a species identified by Professor Cope as above: "Besides those already named, some few years ago a species was killed in our harbor and brought on shore which no one knew. I examined it, and found it to differ from all other species. Not long after it was announced in the papers that there was a white whale on exhibition at the Aquarial Gardens in Boston, that Mr. Cutting had brought alive from the river St. Lawrence; a species that had never been seen south of that river. Soon after I visited Boston and called to see it. I pronounced it to be identical with the unknown species taken at Provincetown." This undoubted occurrence of the white whale at Provincetown is the only instance of its having been found so far south that has come to my knowledge. The skeleton of the specimen exhibited at the Boston Aquarial Gardens, and referred to above by Captain Atwood, is in the Museum of Comparative Zoology. It was presented by Mr. Cutting.

33. [**? Lagenorhynchus** sp.] "COW FISH. Occasional.

"This species differs from the blackfish in being much smaller, and in yielding much less oil. Its blubber is thinner, and its color is a light marble. It is sometimes called white blackfish by our whalers. It is occasionally killed here, but it does not appear in large schools, like the blackfish. It is a distinct species, intermediate in size between the blackfish and the species we call porpoise (dolphin)."

34. [**Delphinus erebennus** COPE. ["PORPOISE. This is not an abundant species here. They are at times in summer seen passing along the shore in large schools, going northward; in autumn they may be seen going back to the southward."

35. **Delphinus clymene** GRAY. According to Professor Cope this species has been taken on the coast of New Jersey,\* and it is not unlikely to occasionally visit our shores.

36. [**Phocæna americana** AGASS. (or *P. brachycium* Cope; I

\* Proc. Phil. Acad. Nat. Sci., 1865, p. 261.



do not know which name will stand as yet.)] “SNUFFER or PUFFING PIG (*Phocaena americana*). This is the smallest of all the species. It is very common here at all seasons, and is occasionally caught in nets set for mackerel or blue-fish.” There are several skeletons in the Museum of Comparative Zoölogy.

### VESPERTILIONIDÆ.

37. *Lasiurus noveboracensis* GRAY. (*Vespertilio noveboracensis* Exhl.) RED BAT. NEW YORK BAT. Common; in some sections of the State the most numerous species of the family.

This species varies greatly in color, but the difference seems to be chiefly sexual. The adult males are generally much lighter than the females. In the young the sexual variation in color seems to be often much less marked.

The only well-marked distinguishing characteristics between this species and the next, except in more highly colored specimens of the latter, is generally the black border to the ear, and the black on the lips in *L. cinereus*. In each there are the same bands of color on the hairs, distributed in the same way, — dusky, verging to black at the base, then pale yellowish brown, succeeded by darker or brighter bands of red, and tipped with whitish. In some specimens the terminal band of whitish is quite absent, particularly on the anterior part of the body, the subterminal bright red zone being thus continuous to the tips of the hairs. In other specimens the terminal band of white is developed to a great degree, so as to very much obscure the red or dark chocolate zone beneath. Such specimens often strongly approximate to what is called *L. cinereus* (*L. pruinus* Say), where the terminal white zone reaches its maximum of development, and the subterminal russet zone its greatest intensity. I feel, in fact, far from sure that the species are distinct. In a series of about twenty Massachusetts skins, nearly all marked for sex by the collector (Mr. C. J. Maynard), all the males are of a beautiful light, bright, yellowish red, with scarcely a trace of the apical white; the females, though somewhat more variable, are universally darker, the light red of the males being replaced in these by dark russet, which is more or less obscured by the whitish tips of the fur. The alcoholic series, so far as carefully examined in reference to this point, indicates this sexual difference to be quite constant; but there are occasional exceptions.

Very little seems to be known respecting the time of copulation or the

period of gestation of the bats. From Mr. J. G. Shute, of Woburn, I learn a fact in reference to this point observed by him some few years since. Soon after sunset one evening in October he observed a strange object pass him in the air, which seemed to fall to the ground not far from where he was standing. Repairing immediately to the spot he soon found it, which proved to be a pair of these bats *in coitu*. They were captured and thrown into alcohol, and thus forwarded to the Museum of Comparative Zoölogy. About the 20th of June I once found, in Northern Illinois, a number of the *Scotophilus georgianus* containing quite advanced fetuses, usually four or five in number. Dr. C. C. Abbott says that the *V. subulatus* brings forth its litter of three to five young late in June.\*

38. **Lasiurus cinereus** H. ALLEN. (*Vespertilio pruinosus* Say.)  
HOARY BAT. Not common. Probably the rarest species of the family found in the State. Though commonly given in New England lists, I have never seen it from Massachusetts. I have been able to find but two specimens in the Museum collection referable to it, and those are, unfortunately, without localities. I have often seen in local collections specimens labelled with this name, but they were only the more hoary form of the common *L. boreboracensis*. From Dr. Allen's list of specimens its range seems to be nearly that of the preceding, — throughout temperate North America at least, — as some of them are stated to have been received from Nova Scotia, Red River Settlement, Louisiana, Matamoras, New Mexico, California, &c. As already observed, I question the validity of this species.

39. **Scotophilus fuscus** H. ALLEN. (*Vespertilio fuscus* Pal. de Bouv.; *V. carolinensis* Geoff. St. Hil.) CAROLINA BAT. Common.

I not only consider the suspicion of Dr. Allen that *S. carolinensis* and *S. fuscus* "may prove to be the same" well founded, but to his list of synonymes of this species would add *Eptesicus melanops* of Rafinesque. I would remove from it the *V. gryphus* of F. Cuvier, which I consider refers to the *V. subulatus* Say.

40. **Scotophilus georgianus** H. ALLEN. Less common than several of the other species, but apparently not excessively rare. There are several specimens in the Museum of Comparative Zoölogy

\* Geology of New Jersey, Appendix, p. 752.

from Massachusetts, and others from Maine, the latter being at present its most northern known locality. This species is believed to be now for the first time reported from the Eastern States.

It appears to me that it would have been better to have entirely ignored the synonymes considered by Dr. Allen as doubtfully referring to this species than to have adopted any of them for its designation. The *V. georgianus* of F. Cuvier seems to me to be undoubtedly referable to *V. subulatus*. If any of F. Cuvier's names are to be considered as referring to it, it seems to me it is the *V. Saleri* of the same data, though it appears highly questionable whether this also, as well as the *V. monticola* of Bachman may not be more appropriately referred to *V. subulatus*, judging from the very imperfect descriptions alone. Dr. Allen, however, has had the types of some of these for examination, and finds them to correspond with what he calls *S. georgianus*, and it is this that appears to have guided him in determining these references.

41. **Scotophilus noctivagans** H. ALLEN. (*Vespertilio noctivagans* Le Conte.) SILVERY-HAIRED BAT. Rather common.

42. **Vespertilio subulatus** SAY. LITTLE BROWN BAT. Common, especially in the Connecticut Valley. At Springfield it is one of the most common, if not *the* most common species.

Prior to the publication of Dr. Allen's monograph, but one species of the genus *Vespertilio*, as now restricted, had been recognized from Massachusetts, though others, based however on very doubtful characters, had been given by different authors from the Middle States. All who have critically studied the bats are well aware that they are quite variable in color and in many other characters. Thus Dr. Allen, under *Scotophilus fuscus*\*, in alluding to certain variations in the form of the ear pointed out by Major Le Conte as distinguishing certain species of European authors, which Dr. Allen very properly deems to be merely nominal, observes: "While acknowledging that these differences may exist, I do not consider them constant. In a species so extensively distributed, and in a family so well known for its Protean tendencies as that to which *S. fuscus* belongs, slight and variable changes, confined entirely to the parts of the ear, are hardly sufficient data for these separations." Under *Vespertilio* † he remarks: "Owing to the fact that species of this genus have a widely spread distribution, minute differences in form and color in specimens brought from distant localities

\* Monograph, p. 33.

† Ibid., p. 46.

have been made of more importance than they deserve. Species have thus sprung up, many of which have never been identified, and seem only to retard progress by a useless synonymy." We fear, however, that Dr. Allen, with all his care, and the almost unexceptionable character of his admirable Monograph, has fallen in this group into an error which he found it necessary to criticise in others. With original specimens of most of his species for examination, I am unable to convince myself, either from these or from his descriptions, that several of the species recognized or described as new by him — especially *V. lucifugus* and *V. evotis*, and also *V. affinis* — are not really referable to *V. subulatus*. Among the large lot of bats furnished by the Museum of Comparative Zoölogy for use in the preparation of his Monograph, including some two hundred specimens from different parts of North America (besides many from foreign countries), specimens of *Vespertilio* from various localities in Maine and Massachusetts were labelled by him, when returned, respectively *V. evotis*, *V. subulatus*, and *V. lucifugus*. Individuals of the same colony, and that I scarcely doubt in some cases belonged to the same litter, of what I call *V. subulatus*, vary considerably in color, and not a little in the form of the ear. Dr. Allen says: "The specimens of *V. subulatus* arrange themselves into two groups, one of which may be considered typical, the other tending in the shape of the ear to the preceding species [*V. evotis*]. Indeed, the changes from one species to the other is so gradual that it is difficult to assign a boundary to each. I have included under *V. subulatus* a number of specimens which have the ear higher than those from which the description has been taken, but agreeing with *V. subulatus* in other particulars."\*

From a critical analysis and comparison of the tables of measurements given by him of the different species of this genus, they appear most decidedly to intergrade, no less in the size and form of the ear — the character on which their separation is mainly based — than in other points. The *V. lucifugus* has, perhaps, the best claims to be regarded as a species, but these seem to be highly equivocal. *V. evotis* is the form with the highest, and relatively the largest ear, grading in this particular into *V. subulatus*, the more common form, and this again into *V. affinis* (of which but one specimen had been received) and *V. lucifugus*, in which the ear exhibits the minimum of size. In the latter the snout is blunter, and in the first more produced, this character correlating with the narrowed and elongated or shortened and blunted ear. In other words, the *V. evotis* is the slender form, the *V. lucifugus* the robust form, *V. subulatus* coming in between the two.† They all appear to have the same geograph-

\* Monograph, p. 51.

† Naturalists seem to overlook the fact that feral animals may vary in size, in general form, in physiognomy, in temperament and disposition, in the same way as different

ical distribution, and specimens of each generally occur in collections from the same localities, whenever the number of specimens received is at all large. They are sometimes found in cool weather clinging together in the same "festoons."

Each species ranges, according to Dr. Allen, from ocean to ocean, and from very far north nearly or quite to the tropics.

Prior to 1864 only five species of bats were currently reported from New England; Dr. Allen's Monograph nearly doubled the number, increasing it to nine. Only six, however, are recognized in the present catalogue, one only (*Scotophilus georgianus*) having been added to those previously well known.

In respect to the many species of bats imperfectly described by some of the earlier authors, I have little hesitancy in referring to *V. subulatus* of Say the following:—

*V. lucifugus* Le Conte, Cuv. An. King. (McMurtrie's ed.), 1831, p. 431.

*V. Caroli* Zimm., Man. de Mam., II, 1835, p. 236.

*V. gryphus* F. Cuv., Nouv. Ann. du Mus. d'Hist. Nat., I, 1832, p. 15.

*V. Salari* Ibid., p. 16.

*V. crassus* Ibid., p. 18.

*V. georgianus* Ibid., p. 16.

*V. subflavus* Ibid., p. 17.

*V. brevirostris* Pr. Maximilian, Verzeich. Beobach. Säugethiere in Nord Amer., p. 19.

*V. monticola* Aud. and Bach., Journ. Phil. Acad. Nat. Sc., Vol. VIII, 1842, p. 280.

*V. virginianus* Ibid., p. 282.

*V. californicus* Ibid., p. 285.

*V. Leibii* Ibid., p. 284.

## SORICIDÆ.

### 43. *Neosorex palustris* VERRILL.\* (*Sorex palustris* Rich.;

individuals of any given nationality of men or breed of domesticated animals, in which such variations are patent to the most casual observer. In wild animals it needs only a critical comparison of many individuals of any species, concerning the identity of which there is no question, to satisfy careful investigators that it is equally the case here. It fails to be as well recognized only because it is impossible for us to be in sufficiently intimate relation with animals in a state of nature. In many instances where they are brought under the same conditions relatively for observation, as in the case of different species of *Cervidæ*, when kept in parks, it is soon detected. In this connection compare the observations of Judge Caton on "American Cervidæ" (*see ante*, p. 194).

\* Notice of a *Neosorex* from Massachusetts, and of *Sorex Thompsoni* from Maine. By A. E. Verrill, Proc. Bost. Soc. Nat. Hist., Vol. IX (Oct. 1862), p. 164.



*Neosorex albibarbis* Cope.) MARSH SHREW. But three specimens of this species are as yet known from New England, two of which were captured by Professor E. D. Cope, at Franconia, N. H., and the other by Mr. F. W. Putnam, at Warwick, Mass. Professor Cope's specimens were swimming in a lake when first seen, about forty feet from the bank. As observed by Professor Verrill, the species of this genus are eminently adapted to an aquatic mode of life, they having large fringed feet and valvular ears.

44. **Sorex platyrhinus** LINSLEY. BROAD-NOSED SHREW. Comparatively common. I have taken a considerable number at Springfield, and Professor S. F. Baird, in his *Mammals of North America* (p. 26), cites nineteen examples in his list of specimens of this species from Massachusetts, eighteen of which were from Middleboro', and collected by Mr. J. W. P. Jenks.

45. **Sorex Cooperi** BACHMAN. COOPER'S SHREW. This rare species I have never seen myself from this State; Professor Baird mentions two specimens from Middleboro', received from Mr. Jenks. Professor Verrill, in his paper already cited, refers to a specimen from Danvers, in the collection of the Essex Institute, as being the only one he had seen from New England. Last winter I received it from Wayne Co., N. Y., from my friend, Mr. Charles Potwine. The specimen was captured in the daytime, while running on the snow in the woods.

46. **Sorex Forsteri** RICH. FORSTER'S SHREW. From its known range\* this species is most likely to occur in Massachusetts. It has, in fact, been reported as often met with here, both in summer and in winter.†

Thompson's shrew (*Sorex Thompsoni* Baird) is also to be expected to occur in this State, it having been received by Professor Baird from Halifax, N. S., and Zanesville, Ohio, and by Professor Verrill from Maine.

\* "Hudson's Bay to Carlisle, Pa." — BAIRD.

† "In the latter season they are found beneath a pile of wood or logs, and their tracks in the snow show their wanderings in search of food." — E. A. SAMUELS, *Agriculture of Mass.*, 1861, p. 142.

47. *Blarina brevicauda*. (*Sorex brevicaudus* Say, Emmons's Rep., p. 13; *Blarina talpoides* Gray). MOLE SHREW. Common. By far the most numerous species of the family.

A second species of *Blarina*, the *B. brevicauda* of Gray (*Sorex brevicaudus* Say) was formerly reported to exist in this State, Connecticut, New York, and throughout Eastern North America generally. But Professor Baird supposes it, if distinct from *B. talpoides*, to be exclusively Western; he has, however, failed to point out any differences of much weight between specimens he refers respectively to *S. brevicaudus* Say and *S. talpoides* Gapper (*B. talpoides* Gray). In his diagnosis of *B. brevicauda* he says: "Largest of all American shrews hitherto discovered (?)," and gives its dimensions as "Length, unstretched, over four inches to the root of the tail"; while he gives the "average length of head and body" of *B. talpoides* as "three and a half inches." Say gives the length of the head and body of *S. brevicaudus* as three inches and five eighths, or 3.62, which but slightly exceeds Professor Baird's average for *B. talpoides*; the two largest specimens of which he gives measurements (No. 2,078, from Massachusetts, and No. 2,116, from Illinois) slightly exceed this size. A Massachusetts specimen before me measures fully four inches, and two others exceed 3.75. Under *B. talpoides* he says, "With a large number of specimens before me, I have been more than usually perplexed in the attempt to determine the species of short-tailed shrews, as given by authors, and especially to distinguish between *S. brevicaudus* and *S. Dekayi*, of Bachman, De Kay, and others. I am satisfied that the latter species is identical with *S. talpoides* of Gapper (which indeed has priority of date), having found no essential differences between Canadian specimens and those from Massachusetts, Vermont, New York, Michigan, Wisconsin, and elsewhere. Gapper's specimen, it will be remembered, was taken in the district between York and Lake Simcoe, in Upper Canada.

"Thus far," he continues, "I have not been able to find any shrews from Massachusetts, New York, or adjoining States, possessing all the characters assigned by Bachman and De Kay. The hair of the same species varies with the season, being longer, softer, and fuller in winter; the precise shade of color is likewise not constant. The proportions of the shrews, unless taken from alcoholic or fresh specimens, vary exceedingly in the same species, according as the skin is under or over stuffed.

"For the present, therefore, I shall refer all the large shrews with short tails from the Atlantic States to the *S. talpoides*. I have, however, before me some specimens from the Upper Missouri and Iowa, which, as they differ in size from any in the East, and agree rather more closely with the *S. brevicaudus* of Say, I shall refer to this species."\*

\* North American Mammals, p. 41.

Under *B. breviceaudus* Professor Baird further observes: "I have found very great difficulty in identifying with any certainty the *S. breviceaudus* of Say, at least in the references to this species, as supposed to be found in the eastern portion of the continent. I have, however, I think, discovered it in some specimens of very large size from Nebraska and Iowa, localities nearer to that of the original specimen (Council Bluffs) than of any specimen yet discovered." In his list of the specimens referred to this species Professor Baird gives two from Nebraska, two from Iowa, and one each from Illinois and Wisconsin. The latter four are, however, referred with a mark of doubt. It is to be regretted that full measurements of all these specimens are not given for comparison with the excellent series of *B. talpoides*; \* as the size of two out of the three given is equalled by several of the *B. talpoides*, they being respectively but 3.50 and 3.65 inches in length. In view of the generally admitted variability of this species in size, color, length of tail, &c., at single localities, and which some seventy specimens now before me from Massachusetts fully demonstrate, and the but slightly larger size of Mr. Say's single example from Council Bluffs (which forms the original of *S. breviceaudus*) than the average of our short-tailed shrews, I refer to one species, and to this of Say, all the short-tailed shrews of the Northern and the Eastern States, Canada and the adjoining Provinces, of which the more recent name (*S. talpoides*) of Gapper becomes a synonyme. Also, in view of the already known wide distribution of this species, and the law of variation in size with respect to latitude and elevation, I must also consider the *S. carolinensis* of Bachman, which only differs from the northern specimens of *S. breviceaudus* (*B. talpoides* Gray, Baird's Report) in its slightly smaller size, as merely the more southern and hence the smaller race. Indeed, in consequence of the large size allowed it by Dr. Bachman, Professor Baird is inclined to consider this name as a synonyme of *B. talpoides*, as under this species he states: "Nor do I feel quite sure that the *Sorex carolinensis* of Bachman is really anything else than a small *S. talpoides*. The measurements given by him (length three inches) agree

\* There has never been a more valuable contribution to the Natural History of the Mammals and Birds of North America, or of any country, than the lists of specimens and tables of measurements published by Professor Baird in his great and invaluable works on these two classes of the North American Vertebrata, contained in Volumes VIII and IX of the Reports of the Pacific Railroad Explorations and Surveys. They show not only, to a considerable extent, the geographical range of the different species, but their variation in size and proportion at different localities, and, when the number is large from one locality, the variation at single localities. The possession of these tables and his accompanying minute descriptions is next to having in hand the specimens themselves. It is very much to be regretted that so small a proportion of our natural history descriptions have been written with this great care and minuteness of detail.

precisely with many from Massachusetts and elsewhere, and are essentially the same in proportion with those of the largest-sized specimens of *S. talpoides*." But he adds: "There is, however, a distinct species in the Southern States, considerably smaller than *S. talpoides*, to which Bachman's name may be applied." Further on he gives a diagnosis of a "*B. carolinensis*," under which he cites Bachman's "*S. carolinensis*" as a synonyme. He describes it as "size considerably less than adults of *B. talpoides*," and gives the length of head and body as "about 2.50 inches." Comparing it with *B. brevicauda*, he says it differs from that species in its considerably smaller size, proportionally smaller feet, and in having the "third and fourth lateral teeth larger in proportion to the first and second," &c. Under this head he cites four specimens, three of which are from Missouri, and the other from South Carolina. These, he says, "agree in the main very well together, and as indicating a southern species smaller than *B. talpoides* or *brevicauda*." After finally referring *S. carolinensis* of Bachman to this species, he says: "I am by no means clear, however, that the particular measurements cited by him do not belong really to a specimen of *B. talpoides*; but," he strangely adds, Dr. Bachman having given us no such intimation, "he [Dr. Bachman] undoubtedly was acquainted with a species smaller than the latter" (*S. carolinensis* Bachman). That there is a somewhat smaller race in the South is unquestionable, but its specific rank is not to me so clear. This smaller form seems to occur generally throughout the Southern States, and along the low coast border as far north as New Jersey, and even perhaps to New York, corresponding in the limits of its distribution northward with the northern boundary of the Carolinian Fauna; the larger form occupying the Northern States generally, and the highlands of the Alleghanies south to Georgia; it thus occurring throughout the whole extent of the Alleghanian Fauna, and possibly throughout the Canadian. The range of *B. brevicauda* is now carried southwards to Florida and Texas, with only such differences in size between northern and southern specimens as are admitted to occur in other unquestioned species of mammals that have the same geographical range; the difference in size being the only constant or tangible distinction yet pointed out. The difficulty experienced by Professor Baird in determining the species of the older authors, it seems to me results chiefly from two causes: first, the imperfect character of the descriptions, which are generally of single specimens only, and of skins and stuffed examples; second, the by far too great number indicated.

In this connection it is proper to notice a species of *Blarina* described as new in the Report on North American Mammals (p. 47) from a single specimen from Burlington, Vermont. This specimen, its describer says, "in external appearance perfectly resembles specimens of *B. talpoides*," but "has

some remarkable peculiarities of the skull. While it has no satisfactory external characters by which to designate it," "the skull is so entirely different from all others" he had seen, he says, as "almost to make a distinct sub-genus." This difference consists in its being much narrower than in other short-tailed shrews, and in the greatest interorbital constriction being placed a little in front of the middle, instead of behind it, as in the others, and in its being greater in amount. In regard to this specimen, I need only add that, in respect to its skull, and in this character alone,\* whether really a distinct species or an abnormal individual variation, it still remains unique, no other like it having yet become known to naturalists.

In continuing this preliminary revision of the *Blarina*, we find that ten species of this strictly American genus † of the short-tailed shrews have been described, all from the United States, three of which were first characterized by Professor Baird in his North American Mammals. Seven are recognized in this work as valid; two are given as doubtful or unidentified, and one is doubtfully referred to one of the others. These are arranged in two sections, according to the number of premolars; section "A" having five, and section "B" four. Their dental formulæ are as follows:—

$$\text{Section A, } \frac{2}{2} + \frac{5-5}{2-2} + \frac{4-4}{3-3} = 32; \text{ section B, } \frac{2}{2} + \frac{4-4}{2-2} + \frac{4-4}{3-3} = 30.$$

A lengthy diagnosis is given of each section, but no other essential differences are pointed out, the distinctions in respect to color, &c., being, as is evident from the descriptions of the species that follow, inconstant and invalid. In section B the first premolar is said to be slightly larger than the second, and in section A to be smaller than the second. But in the de-

\* That is, judging from Professor Baird's description; but from the figures of its skull (Pl. XXX, Fig. 7), it seems to have had an imperfect or abnormal dentition, the number of visible premolars being three instead of four, in the upper jaw, and one instead of two in the lower, with a naked space between them and the incisors. It is possible, however, that the first premolar in each jaw had become accidentally lost before the skull passed into the hands of the artist.

† *Sorex brevicaudus* SAY, Long's Exped., I. 1823, 164.

" *parvus* SAY, Ibid., 163.

" *talpoides* GARTER, Zool. Journ., V, 1830, 208, Pl. VIII.

" *carolinensis* BACHMAN, Journ. Phil. Acad. Nat. Sc., VII, 1837, 366, Pl. XXIII, Fig. 1.

" *cinereus* Ibid., 373, Pl. XXIII, Fig. 3.

" *Dekayi* Ibid., 377, Pl. XXIII, Fig. 4.

" (*Brachysorex*) *Hurlani*, DUVERNOY, Mag. de Zool., 1842, 40, Pl. III, Fig. 6.

*Blarina angusticeps* BAIRD, N. Am. Mam., 1857, 47.

" *exilipes* Ibid., 51.

" *Berlandieri* Ibid., 53.



scriptions of *B. cinerea*, *B. Berlandieri*, and *B. exilipes*, which constitute section B, it is distinctly stated that the first premolar is *smaller* than the second. Figures of the skulls of all the species of both sections are given in Pls. XXVIII and XXX, but in no case does the first premolar *appear* to be quite equal to the second. In regard to section B, there are several circumstances suggestive of its being founded on immature examples of section A, in which the dentition is incomplete.\* All the species are diminutive, and vary but little in size; the teeth are generally proportionally large compared with the size of the skull, as is always the case in young animals, and other characters seem to indicate immaturity. The missing premolar is the one we should expect the animal to acquire latest.† All the species of section B come from within the admitted geographical range of the species of section A, one only (*B. Berlandieri*) possibly excepted. Unfortunately, very young specimens of shrews are extremely rare in collections, and in the large series of *Blarina* in the Museum of Comparative Zoölogy there are none so small as those embraced under Baird's section B. In several of the smallest of them the fifth premolar is scarcely visible, forming a minute uncolored point on the inside of the jaw. In a single specimen from Middleboro', the smallest of the lot, it is wholly wanting. I regret that I have been unable to examine any of the original types of the species of section B. Between the three supposed species of this section (*B. cinerea*, *B. exilipes*, *B. Berlandieri*) the differences (which seem to consist chiefly in color, especially between the first two) are not greater nor different from those seen in a large series of specimens from Massachusetts or other localities. The differences between the different specimens referred to either of the species are also very appreciable, and in some cases (see under *cinerea* and *exilipes* in North American Mammals) so great that their assignment was very doubtfully made. While the evidence of the existence of so many species of *Blarina* in the Eastern United States, if really of more than one, is evidently very slight, I do not claim to have fully shown that but the one exists; my design has been mainly to call attention to the great need of a thorough revision of this

\* It is well known that in *Scalops aquaticus* the number of teeth in the young is less than in the adult, and this difference has resulted in discrepant statements in respect to its dentition. (See BACHMAN on the Mole Shrews of North America, in Proc. Bost. Soc. Nat. Hist. I, 40. Also, Quad. N. Amer., Vol. I, p. 92.)

† The species of *Sorex* are divided into two sections on similar characters, where small size again accompanies the lesser number of teeth. There are other circumstances that render it not improbable that we have here again a section "B," based on immature representatives of a section "A." The number of species of *Sorex* admitted for the United States, twelve or more, is probably quite too large, though undoubtedly there may be half that number.

group. What I do claim is, that there is as yet no good evidence of the existence of more than the common and widely dispersed *B. brevicauda*; that the numerous other supposed species that have been described are mainly based, in the first section, on variations in size dependent upon locality, and that there are strong indications that those of the second section rest on variations, dependent upon immaturity, of the representatives of the first; that if other species do exist, as is not of course improbable, naturalists have thus far failed to satisfactorily establish the fact. In number of species, *Blarina* thus corresponds with *Condylura*, and in distribution with *Scalops aquaticus*.

In the following comparative analysis of the diagnoses of sections A and B of *Blarina*, given in the Report on North American Mammals, some points but casually alluded to above are more fully discussed. A table of synonymes is also added.

## Genus *Blarina* GRAY.

### LIST OF THE SPECIES.

#### SECTION A.

*B. talpoides*.

*B. brevicauda*.

*B. carolinensis*.

*B. angusticeps*.

#### SECTION B.

*B. cinerea*.

*B. exilipes*.

*B. Berlandieri*.

### DIAGNOSES.

#### *Color.*

"Nearly uniform plumbeous on the body and tail; scarcely lighter beneath."

*Exceptions.* — Specimens of *B. talpoides* are mentioned as "slightly paler beneath," "fading to the belly into a still paler tint," &c.; of *B. carolinensis* as being "a little paler beneath." Massachusetts specimens of *Blarina* are generally nearly uniform, but many specimens occur that are considerably lighter beneath. The general color also varies from ashy and brownish through grayish plumbeous to exceedingly dark, almost black. Occasionally the hairs are so varied with light and dark as to present a hoary appearance.

"Lower parts of the body usually lighter than the upper, with the line of demarcation distinctly visible."

*Exceptions.* — *B. cinerea*: Hoary above, "somewhat resembling pepper and salt"; below, "a lighter tint of brownish gray or light ash; the line of demarcation in one specimen indistinct, in another more evident." *B. Berlandieri*: "In one [specimen] the prevailing tint is a chestnut brown at the tips of the hairs, with paler next to the tips, producing a slight hoariness. The under parts are a yellowish-brownish white; the line of demarcation on the sides quite indistinct."

*Dental Formulæ.*

$$\frac{2}{2} + \frac{5-5}{2-2} + \frac{4-4}{3-3} = 32$$

$$\frac{2}{2} + \frac{4-4}{2-2} + \frac{4-4}{3-3} = 30$$

*Incisors.*

(1)\* "The upper anterior incisor with the basal portion of the cutting edge formed by a nearly rectangular lobe, (2) the entire tooth forming only a single hook."

"Lower anterior incisor (1) *stout*, (2) *much curved*, (3) *with two or three lobed dentations*." (4) "It extends back as far as the middle of the first molar." (5) "*The first and second premolars are placed above this incisor.*"

The variation presented by different specimens renders null distinctions 1 and 2, the lobe being sometimes much produced posteriorly.

(1)\* "Anterior upper incisor with the basal lobe more conical and further forward than in the other section."

"Lower anterior incisor (3) *with two or three lobed serrations*, (1) *stout*, (2) *much curved*, (4) not reaching posteriorly as far as the middle of the first molar; (5) *the two first lateral teeth entirely above it.*"

On page 9, the teeth in section A are described as "nearly uncolored,"—that is, brown to the base, and in section B as "bicolored,"—white at the base and tipped with brown. But in *B. brevicauda*, the second type of coloration is also quite frequent.

*Upper Premolars.*

(1) "The first two premolars are nearly equal, (2) the second *usually* a little larger; (3) the next two much smaller; (4) the fifth very small and usually not visible externally. (5) The first four with a basal-colored point on the inner side."

(1) "The first premolar tooth slightly larger than the second. (2) *The third decidedly smaller than either*, though larger than in the other group. (5) The small cusps on the inner side of the base of the first three lateral teeth, either wanting or very small."

*Exceptions.* — *B. cinerea*: "The first premolar tooth is a little *smaller* than the second."

*B. exilipes*: "The first lateral tooth is *rather smaller* than the second," &c.

*B. Berlandieri*: The first lateral tooth is "rather shorter than the second." See also the figures, which so represent them. Hence this main distinction of "first premolar tooth slightly larger than the second" by no means holds.

\* The numbers prefixed to the characters in the diagnoses refer to the same character in each section. Those that seem to be nearly or quite synonymous in the two sections are italicized.

*Hands.*

"Hand contained about two and a third times in the hind feet."

In forty-seven specimens of *B. talpoides* the proportion is 74 to 100; in three specimens of *B. brevicauda* the proportion is 72 to 100; in three of *B. carolinensis* it is also 72 to 100. The range of variation, however, in *B. talpoides* (see Baird's table) is from .55 (specimens No. 2,076, 2,080, &c.) to .80 (specimen No. 2,083).

"Feet smaller than in section A; the anterior contained about one and a half times in the posterior."

In four specimens of *B. cinerea* the proportion is 75 to 100; in six specimens of *B. exilipes* 68 to 100; in four of *B. Berlandieri* 66 to 100.

Before closing my remarks on this subject I should call attention to the fact of the repetition of the same character, described in slightly different language, that so constantly occurs in diagnoses of the different species of the same genus, of different genera of the same sub-family, &c., and even of characters of ordinal value in specific descriptions, in the writings of even some of the best naturalists;—to the mixing up of non-essential or irrelevant characters with, and thus obscuring, those peculiar to the group in question. Sometimes, in fact, the really essential points are omitted, the diagnosis being almost as equally applicable to several species, or to any of quite a large group, as to one. All naturalists are not, of course, equally culpable in this respect. But in general, by sifting descriptions of their generalities, they could be greatly reduced and their definiteness and accuracy proportionally increased. The labor of preparing diagnoses would of course be thus increased, but the advantages arising therefrom would be immense. I am not the first, I am happy to find, to make strictures of this character, and hope that the matter will soon receive at the hands of descriptive naturalists the consideration it merits. Neither, I should say, are these strictures introduced at this time as a special criticism upon any particular author.

*Blarina brevicauda.*

*Sorex brevicaudus* SAY, Long's Exped., I, 1823, 164.

" " HARLAN, Faun. Amer., 1825, 29.

" " GODMAN, Am. Nat. Hist., I, 1831, 79. (From Say.)

" " BACHMAN, Journ. Phil. Acad. Nat. Science, VII, 1837, 381.

" " EMMONS, Quad. Mass., 1840, 13.

" " DE KAY, N. York Fauna, I, 1842, 18.

- Sorex brevicaudus* LINSLEY, Am. Journ. Sc., XLIII, 1842, 346.  
 " " THOMPSON, Hist. Vermont, 1842, 27.  
 " " PLUMBER, Am. Journ. Sc., XLVI, 277.  
*Blarina brevicauda* BAIRD, Mam. N. Am., 1837, 42, Pl. XXX, Fig. 5.  
 " " SAMUELS, Agr. Mass., 1861, 144.  
*Sorex talpoides* GAPPER, Zool. Journ., V, 1830, 208, Pl. VIII.  
*Corsira (Blarina) talpoides* GRAY, Proc. Lond. Zool. Sc., V, 1837, 124.  
*Blarina talpoides* BAIRD, Mam. N. Am., 37, Pl. XXX, Fig. 6.  
 " " SAMUELS, Agr. Mass., 1861, 145.  
 " " VERRILL, Proc. Bost. Soc. Nat. Hist., IX, 1863, 172.  
*Sorex parvus* SAY, Long's Exped., I, 164.  
 " " HARLAN, Faun. Am., 29.  
 " " BACHMAN, Journ. Phil. Ac. N. Sc., VII, 394. (From Say.)  
 " " DE KAY, N. Y. Fauna, I, 19.  
 " " LINSLEY, Am. Journ. Sc., XLIII, 346.  
 " " AUD. & BACH., Quad. N. Am., II, 1851, 145, Pl. LXX.  
 " *Dekayi* BACHMAN, Journ. Phil. Acad. Nat. Sc., VII, 377, Pl. XXIII,  
 Fig. 4.  
 " " DE KAY, N. Y. Fauna, I, 17, Pl. V, Fig. 2.  
 " " LINSLEY, Am. Journ. Sc., XXXIX, 388, Ib. XLIII, 346.  
 " " AUD. & BACH., Quad. N. Am., III, 1853, 246, Pl. CL, Fig. 2.  
 " *cinereus*\* BACHMAN, Journ. Phil. Acad. Nat. Sc., VII, 373, Pl.  
 XXIII, Fig. 3.  
*Blarina carolinensis* BAIRD, Mam. N. Amer., 45, Pl. XXX, Fig. 8, skull.  
 " *angusticeps* Ib., 47, Pl. XXX, Fig. 7, skull.  
 " *cinerea* Ib., 48, Pl. XXX, Figs. 9 & 10, skulls. (Young.)  
 " *exilipes* Ib., 51, Pl. XXVIII. (Young.)  
 " *Berlandieri* Ib., 53, Pl. XXVIII. (Young.)

## TALPIDÆ.

48. **Scalops aquaticus** FISCHER. (*Scalops canadensis* Emmons, Rep., p. 15.) COMMON MOLE. Common.

49. **Scalops Breweri** BACH. HAIRY-TAILED MOLE. Apparently rare in Massachusetts, and not numerous anywhere. The original specimen described by Dr. Bachman came from Martha's Vineyard, and was collected by Dr. L. M. Yale, and presented by Dr. T. M. Brewer

\* Afterwards considered by Dr. Bachman to be the young of *S. carolinensis*. See Quad. N. Am., III, p. 344. Same as *B. cinerea* Baird.



to Dr. Bachman. There is a specimen in the Museum of Comparative Zoölogy from Warwick, and others from Upton, Maine, and Haldsburg, Pennsylvania.

50. **Condylura cristata** DESMOREST. (*C. longicauda* Desm. and *C. macroura* Harlan of Emmons's Rep., pp. 17, 18.) STAR-NOSED MOLE. Common, but apparently more so in some parts of the State than in others. At Springfield this and *Scalops aquaticus* are about equally numerous, but in the eastern part of the State the present species seems to many times outnumber the other. From considerable variations in the length and size of the tail presented by different individuals, it was formerly incorrectly supposed that two species of *Condylura* existed in Massachusetts, and the eastern parts of the United States generally. The thickening of the tail appears to be connected with the rutting season.

#### SCIURIDÆ.

51. **Sciurus cinereus** LINN. (? "*S. vulpinus* Gmel.," Emmons's Rep., p. 66.) FOX SQUIRREL. Rare in most parts of the State.

52. **Sciurus carolinensis** GMELIN. (" *S. leucotis* Gapper" and "*S. niger* Linn.," Emmons's Rep., pp. 66, 67. *Macroxus*\* *carolinensis* Gray.) GRAY SQUIRREL. Generally distributed, but much more common in some sections than in others, being most numerous where the forests have been least disturbed. Generally they are of the gray type, but the black variety is quite prevalent at some localities. In Wayne County, New York (on the south shore of Lake Ontario), I have found the black variety to be the most common, with every gradation between the two. All those observed that were pure glossy black seemed to be very old individuals, while the young generally presented a mixture of tawny, gray, and black, the hairs being annulated

\* Dr. J. E. Gray, in his several Synopses of the Asiatic, African, and American Squirrels (Ann. and Mag. Nat. Hist., 3d Ser. Vol. XX, 1867), has recently divided the old genus *Sciurus* into several genera. *Sciurus*, as restricted by him, and *Macroxus* contain all the American species, by far the larger part of which are placed in *Macroxus*. Only the group to which *S. hudsonius* belongs, the *S. cinereus* or Northern fox squirrel, and Abert's squirrel from New Mexico (called by Gray *S. "Albertii"* = *S. Abertii* Woodhouse), remain in the genus *Sciurus* as restricted by Dr. Gray.

with these colors, varying in the proportion of each in almost every individual. The intensity of the black appears to increase with age.

Dr. Emmons's *S. vulpinus* seems to refer to large examples of this species rather than to the true fox squirrel (*S. cinereus* Linn.).

53. **Sciurus hudsonius** PALLAS. RED SQUIRREL. CHICKAREE. Abundant.

The variations in color, in the hairiness of the soles, the presence or absence of ear-tufts, according to the season of the year, in this and other species, have already been pointed out by Professor Baird.\* The lateral dusky stripe is perhaps the most variable feature in the present animal, in many specimens it being quite absent, and in the greater portion but faintly indicated, but it is not unfrequently one of the most conspicuous features of coloration. In fall specimens, particularly around Springfield, the black lateral line is generally conspicuous, being a well-defined, quite broad black band. Specimens from Northern Maine† differ from the majority of Massachusetts specimens in possessing a relatively very much shorter tail, somewhat in general color, the back being "rusty-yellow" rather than ferruginous, and in the greater fulness and softness of the fur. The black at the end of the tail is much broader and more conspicuous. In several points these specimens thus approach *S. Richardsonii*. Specimens entirely black have been received from Mr. G. A. Boardman from near Calais, Maine. In view of the wide range of variation presented by *S. hudsonius*, the descriptions of some of its near allies, especially of *S. Fremontii* and *S. Richardsonii* of Townsend and Bachman, seem scarcely to indicate more than slight local variations of one species. The specimens of the latter thus far examined have been too few to establish any very important differences between them and *S. hudsonius*, if such exist.

Professor Baird in his admirable article on the *Sciurineæ*, or typical squirrels of the United States, was able, through the very abundant material at his disposal, to eliminate a very large proportion of the invalid species that had from time to time crept into the works of preceding authors, including many described by Bachman and other Americans as well as by foreign naturalists. The variations pointed out by him as being dependent upon season and locality are important discoveries, since such variations are also of common occurrence among other groups. Two or three species only, besides those above specified, of the twelve species of *Sciurus* admitted in the work of this author seem at all questionable. These

\* N. Amer. Mam., pp. 244 and 270.

† In the Mus. Comp. Zool., and C. J. Maynard's collection.

are the *S. castanonotus* and *S. limitis* from the little known region of Northern Mexico and the adjoining Territories northward, whose somewhat doubtful character is particularly mentioned.

Dr. Gray, in his "Synopsis of American Squirrels," \* quotes Professor Baird's remarks respecting the wide variation in color presented by individuals of the same litter, the geographical variation in size, the variations in the hairiness of the soles of the feet at different seasons and between northern and southern representatives of the same species at the same season, and also in respect to the absence or presence of the ear-tufts in different individuals of the same species from the same locality; and so far as he has followed Baird's memoir his paper is to be commended. As soon, however, as extralimital species are encountered he seems to have lost sight of all these important facts quoted by him, and takes every considerable variation in color as the basis of a species. Hence the greater part of those described by previous authors receive his approval, and some *ten or twelve*, apparently, are added as new! The whole number of American *Sciuri* is thus increased to thirty-nine species. That some of the Mexican species are as variable as those of the United States is beyond question, while it is probable that some of the still more southern ones also are. According to Dr. Gray, the number of species of Asiatic *Sciuri* is forty-nine, an improbably large number, from which the excess can only be properly eliminated by a careful observer residing where these animals live, and the elaboration of a mass of material far greater than has thus far been brought together.

54. ***Pteromys volucella* DESM.** FLYING SQUIRREL. Common, but, from its nocturnal habits, not often seen.

Apparently equally mature individuals from the same locality are quite variable in size, and somewhat in other characters. One, remarkably large, collected by Mr. S. Jillson at Hudson (Mass.), corresponds very well with the *P. hudsonius* Fischer (*P. sabrinus* Rich.), which supposed species is almost unquestionably but the large northern race of *P. volucella*.

Richardson described, in the "Fauna Boreali-Americana," † a variety of his *P. sabrinus* from the Rocky Mountains, to which he gave the name *alpinus* (*P. sab.*, var. *alpinus*). Wagner, in his Supplement to Schroeber's Säugethiere, ‡ and Audubon and Bachman in their North American Quadrupeds, § afterwards raised it to the rank of a species, but apparently with insufficient reason. Professor Baird also admits *P. alpinus* as a species in

\* Anp. and Mag. Nat. Hist., 1867, p. 415.

† Vol. I, p. 195, pl. 18.

‡ Vol. III. p. 230.

§ Vol. III. p. 206.

his Mammals of North America (p. 289), but remarks that, from insufficient data, he was unable to arrive at a definite conclusion as to whether it was really distinct from *P. hudsonius*. The *P. oregonensis* of Bachman seems also very doubtfully distinct from *P. volucella*, as it does not differ very appreciably from the Eastern animal. The following remarks from Audubon and Bachman's North American Quadrupeds\* in respect to the number of species of North American *Pteromys* are very suggestive. "As long," they observe, "as only two species of flying squirrel were known in North America, — the present species (*P. sabrinus*) and the little *P. volucella*, — there was no difficulty in deciding on the species, but since others have been described in the far West, the task of separating and defining them has become very perplexing."

Specimens in the Museum of Comparative Zoölogy from Lake Superior, Northern Maine, New Hampshire, Massachusetts, and the Middle States, form a graduated series in size, the first-mentioned, or northern, corresponding with the *P. "sabrinus"*; the southern, of course, with the true *P. volucella* of authors. Difference in size has been the only appreciable character that has been advanced as distinguishing them.

55. **Tamias striatus** BAIRD. (*T. americanus* Kuhl. *Sciurus striatus* Klein, Emmons's Rep., p. 68.) STRIPED SQUIRREL. CHIPMUNK. Abundant. Usually first seen abroad in spring towards the close of March, when they are readily detected by their loud clucking note.

A series of nearly fifty specimens in the Museum of Comparative Zoology, from various localities in Eastern Massachusetts, are extremely uniform in color, the variations being so slight as to be scarcely appreciable. A considerable number of others, from different localities in Maine, are generally very much lighter or paler colored. These, also, vary a good deal among themselves, chiefly, however, in the character of the stripes, which in several specimens are much less distinct than usual. In one they are quite faint and irregular, the light central one on the sides being alone well defined, and this is at one point interrupted. The difference in general tint between these Massachusetts and Maine specimens is quite marked in the rufous-colored regions of the animal, and especially on the posterior part of the back.

56. **Arctomys monax** GMELIN. WOODCHUCK. Abundant. At Springfield a number of specimens of the black variety have been taken within the last few years, and also three albinos. One of these is nearly white (pale grayish-white), and the other two are pale yellowish-brown

\* Vol. III, p. 205.

or cream-colored. The latter are preserved in the Springfield Natural History Museum.

I have known of a few instances of the capture of this species in nearly midwinter. Once a specimen was taken running in the highway early in February, when the snow was a foot and a half deep. They generally leave their burrows very early in spring, often before the ground is fully thawed, but for some time after are irregular in going abroad, and are able to remain six or eight days inside their burrows without food, as they will often do when a trap is set for them. Till the season and vegetation are somewhat advanced they seem to take or require but little nourishment. Later, and especially after the birth of the young in June, they are forced in a much shorter time to leave their holes to obtain food. In fall they become very fat, and early in October generally permanently retire to their burrows, or at least go abroad then much less frequently than earlier, and apparently take very little food.

The Beaver (*Castor fiber* Linn.; *C. canadensis* Kuhl) is to be reckoned among those few animals that, in this State, have become fully exterminated.

The few differences pointed out by authors between the European and American beavers, including the distinction based on a comparison of the skulls, are too trivial, in the light of the extensive individual variations now so well known to be almost invariably presented by a large series of specimens of the same species from any given locality, to be taken as satisfactory evidence of their diversity. The weight of authority is also by far in favor of their identity.

**57. *Jaculus hudsonius* BAIRD.** (*Meriones*\* *hudsonius* Aud. and Bach.) JUMPING MOUSE. Rather common, but far from numerous.

This species has distinct cheek-pouches, — a fact I have not before seen stated.

**58. *Mus decumanus* PALLAS.** BROWN RAT. WHARF RAT. NORWAY RAT. Abundant in the cities and larger villages generally; rare or quite unknown in the remote farming districts.

\* *Meriones*, F. Cuvier, Dents des Mam., 1825, 187; type, *Dipus americanus* Barton. Not *Meriones* Illiger, Prod., 1811.



59. **Mus rattus** LINN. BLACK RAT. Abundant in the farming districts, but rare wherever the brown rat is numerous. In the vicinity of Boston and of the larger cities generally it seems to be quite unknown. Twenty or thirty miles from the coast, and at a little distance from the large towns along the railways, it becomes numerous, and the only species there found. The brown rat is its mortal enemy. With age this species changes from black to gray, very old individuals becoming very light colored.

60. **Mus musculus** LINN. HOUSE MOUSE. Everywhere a numerous pest. Is frequent in the fields under stacks of grain as well as in houses and outbuildings.

61. **Hesperomys leucopus** LECONTE. (*H. leucopus* and *H. myoides* Baird.) WHITE-FOOTED MOUSE. DEER MOUSE. A common species of the fields and woods. In winter it (sometimes at least) retires to a warm nest in a hollow stump or log, in which in severe weather I have found five or six together in a torpid state.

No species of our *Muride*, excepting possibly the *Jaculus hudsonius*, presents so great variations in color with season and age as the present. The young for the first two or three months, or till nearly full-grown, are dark slate or plumbeous above, somewhat lighter below. From the casting of the winter coat in spring till late in autumn the adult differs more or less in color with almost every individual, none presenting the bright yellowish or ferruginous brown seen in winter and early spring, but every stage between it and the plumbeous hue of the young; the adult being also more or less dusky for some time after moulting. Generally there is a darker band along the back, varying in width in different specimens, and in distinctness of outline; sometimes, however, the back is uniform in color with the sides. The variation in size is also considerable between specimens apparently fully adult. The tubercles on the soles of the hind feet, on which specific distinctions are sometimes based, vary both in relative size and position. The posterior one is usually situated midway between the toes and the heel, but sometimes more posteriorly or more anteriorly. The next one is placed between this and the third, and is usually nearer to this than to the first, it being sometimes opposite to the third. The third anterior tubercle occasionally has a minute supplemental one at its outer base. But the most variable character consists in the relative length and number of the caudal vertebræ. About one fifth of the Massa-



chusetts specimens have the tail vertebræ equal to or longer than the head and body together; occasionally a specimen is found in which the tail vertebræ alone exceed this length by one fourth to one half an inch. At least four fifths, however, have the tail shorter than the head and body, and occasionally one occurs with the tail only equal to the body alone. In these latter the proportional length of the tail vertebræ to the length of the head and body is as 68 to 100; in the other extreme, or in those with long tails, as 118 to 100. The variation between these extremes is hence about fifty per cent of the mean, — a striking example of the unreliability of this character as a specific distinction already claimed in discussing the species of *Mustelide*. The number of the vertebræ varies from twenty-four or twenty-five to above thirty. In regard to absolute size, the length of the head and body together, in Massachusetts specimens, rarely exceeds four inches; the average is between three and a quarter and three and a half; perhaps nearer the latter. The variation in this respect is well illustrated in Professor Baird's table of measurements of a large number of Middleboro' and other specimens of this species, given in the Mammals of North America (p. 462).

Through the seasonal and other variations in color, as well as in size and proportions, it becomes extremely difficult to distinguish the different North American species of the restricted genus *Hesperomys*, if so many species are to be recognized as have been described, similar variations apparently occurring in all the species. That several exist in the eastern part of the United States seems unquestionable, but the validity of many that have been described from this region is at the same time highly doubtful. The *H. gossypinus*, as defined by Professor Baird, would at first seem readily distinguishable by its comparatively large size, coupled with a southern habitat and its short tail; in color and proportions it closely resembles *H. leucopus*. But since in *H. cognatus* we have a form intermediate between the two and intimately allied to both, the true standing and affinities of each of the three become questionable. Some specimens of *Hesperomys* before me from Florida\* differ in no essential particular from examples of *H. leucopus* in summer pelage from Massachusetts and Maine. Well-marked examples of either of the two first mentioned of these so-called species seem sufficiently distinct, but a large series of specimens is constantly presenting intermediate stages, and a large amount of variation in each of the would-be distinctive characters. A single Florida specimen of *H. Nuttalli* (*Mus aureolus* Aud. and Bach.) differs much in color from the other Florida specimens of *Hesperomys*, and from *H. leucopus*.

\* In addition to the specimens collected by myself in Florida the past winter, I am indebted to Mr. C. J. Maynard for the opportunity of examining others obtained there by himself the same season.

*H. michiganensis*, of which I have also had fresh specimens for examination, seems as well marked as any of the group, through its small size, very short tail, and dark plumbeous color at all seasons. Other specimens collected by myself in Western Iowa, supposed from their locality to be referable to *H. sonoriensis*, differ in no way appreciably, except in being a little lighter colored, from average specimens of Massachusetts *H. leucopus*.

*H. myoides*, described by Baird from Canada and Vermont specimens, is positively identical with *H. leucopus*, the cheek-pouches — the only character supposed to distinctively characterize it — being probably common to all the species of the genus, as well as to *Jaculus*.\* I first became aware of the existence of cheek-pouches in *H. leucopus* by capturing the animal with the pouches distended with seeds and grain; a subsequent examination of many specimens in alcohol from Berlin, Middleboro',† Springfield, and other localities in Massachusetts, and from Waterville, Norway, Bethel, Upton, and other places in Maine, has fully confirmed this discovery, as I have yet to find the first specimen without the pouches. They almost uniformly exist as described by Gapper, — that is, extending upwards to the eye and posteriorly to the ear. They are equally well marked in specimens of *H. gossypinus* and *H. "cognatus,"* from Florida. ‡

In the large proportion of equivocal species included among the thirteen recognized in the General Report, to which one since described from In-

\* See *antea*, p. 226.

† The Middleboro' specimens were collected by Mr. J. W. P. Jenks, and presented by the Smithsonian Institution to the Museum of Comparative Zoölogy, labelled "*Hesperomys leucopus*."

‡ In the Report on North American Mammals (p. 460) it is stated, "No traces of cheek-pouches can be detected" in *H. leucopus*. Under *H. myoides* the same author remarks (*Ib.*, p. 472) that he found, much to his astonishment, decided indications of cheek-pouches in all the alcoholic specimens of that "species" he examined. "I then," he says, "investigated a considerable number of Middleboro' specimens, and in none could I detect the slightest indication of anything of the kind." "In another specimen," he says later (No. 2776), "from Waterville, New York, referable probably to the same species [*H. myoides*], I found the cheeks crammed with large seeds, and on cutting them open could see that the latter occupied a pouch of considerable size. It is possible that this specimen (immature) may not belong to *H. myoides*, if so, we must conclude that in the ability to distend the cheeks very much, even temporarily, the *H. leucopus* approaches very closely to the *H. myoides*, and this diminishes still more the propriety of placing the latter in a distinct genus. It is quite possible that others of our species may have the cheek-pouches more or less developed." It hence appears that the existence of cheek-pouches in the other species of *Hesperomys* was finally strongly suspected by the author in question. The oversight of their presence in *H. leucopus*, however, is somewhat surprising, since they are not difficult to discover in specimens preserved in alcohol, when search for them is properly made, though in specimens badly contracted by the alcohol they might quite readily escape observation.

diana by Prince Maximilian is added,\* there are besides the several doubtful ones already mentioned, others equally questionable. Of those assigned to that part of the United States east of the Rocky Mountains, the *H. michiganensis*, *H. leucopus*, and *H. Nuttallii* (*aureolus* Aud. and Bach.), seem to be those best entitled to recognition, while possibly *H. gossypinus* may be also valid; but with my present knowledge of the subject, I fail to see why *H. texanus*, *H. indianus* (of Prince Maximilian), *H. sonoriensis*, *H. myoides*, and *H. cognatus*, should be thus regarded, all but the latter, and perhaps also both this and *H. gossypinus*, being apparently referable to *H. leucopus*. I do not hesitate to thus refer *H. sonoriensis*, and *H. myoides*, both of which I have examined in the fresh state, and numbers of the latter that were preserved in alcohol.

Of the Pacific Coast species, of which at least five have been described, several are intimately allied to the *H. leucopus* of the East, as well as to each other. Whether any of them are identical with *H. leucopus* is not at present, from want of sufficient material, easy to decide. Should they prove to be so, it would substantiate a more extended geographical range for *H.*

- \* 1. *Hesperomys leucopus* BAIRD, N. Am. Mam., 1857, 459; = *Musculus leucopus* RAFF., Amer. Monthly Mag., III, 1823, 307.
- 2. *Hesperomys myoides* BAIRD, N. Am. Mam., 472; = *Cricetus myoides* GAPPER, Zool. Journ., 1830, 204.
- 3. *Hesperomys indianus* MAXIMILIAN, Archiv für Naturgesch., XVIII, 1, 1862, 111.
- 4. *Hesperomys sonoriensis* LECONTE, Proc. Phil. Acad. Nat. Sci., VI, 1853, 413; = *H. sonoriensis* BAIRD, N. Am. Mam., 474.
- 5. *Hesperomys texanus* WOODHOUSE, Proc. Phil. Acad. Nat. Sci., VI, 1853, 242; = *H. texanus* BAIRD, N. Am. Mam., 464.
- 6. *Hesperomys Nuttallii* BAIRD, N. Am. Mam., p. 467; = ? *Arvicola Nuttallii* HARLAN, Month. Amer. Journ., 1832, 446; = *Mus* (*Calomys*) *aureolus* AUD. and BACH., Jour. Phil. Acad. Nat. Sci., VIII, 1842, 302.
- 7. *Hesperomys cognatus* LECONTE, Proc. Phil. Acad. Nat. Sci., VII, 1855, 442; = *H. cognatus* BAIRD, N. Am. Mam., 469.
- 8. *Hesperomys gossypinus* LECONTE, Proc. Phil. Acad. Nat. Sci., VI, 1853, 411; = *H. gossypinus* BAIRD, N. Am. Mam., 469.
- 9. *Hesperomys Boylii* BAIRD, Proc. Phil. Acad., VII, 1855, 335; = *Ibid.*, N. Am. Mam., 471.
- 10. *Hesperomys californicus* BAIRD, N. Am. Mam., 478; = *Mus californicus* GAMBEL, Proc. Phil. Acad. Nat. Sci., IV, 1848, 78.
- 11. *Hesperomys eremicus* BAIRD, N. Am. Mam., 479.
- 12. *Hesperomys austerus* BAIRD, Proc. Phil. Acad. Nat. Sci., VII, 1855, 336; = *Ibid.*, N. Am. Mam., 466.
- 13. *Hesperomys Gambelii* BAIRD, N. Am. Mam., 464.
- 14. *Hesperomys michiganensis* WAGNER, Archiv für Naturgesch., 1843, 2, 51; = *Mus michiganensis* AUD. and BACH., Journ. Phil. Acad. Nat. Sci., VIII, 304; = *H. michiganensis* BAIRD, N. Am. Mam., 476; = *Mus Bairdii* HOY & KENNICOTT, Patent-Office Rep., Agr., 1856 (1857), 92.

*leucopus* than many of the rodents possess, particularly the smaller species, but no greater than seems to be admitted for *Jaculus hudsonius*, its somewhat near ally. The habitat of *Jaculus hudsonius*, as now commonly defined, extends from ocean to ocean, and from the Arctic regions southward through at least the Middle States and to Missouri. This, also, is a species remarkable for its variability in color, size, proportional length of the tail to the body, etc.; but in the General Report on the Mammals of North America these differences were allowed only their proper value, and several species of authors were reduced to synonyms in consequence. Had the same course been taken in respect to the genus *Hesperomys*, undoubtedly a large proportion of the nominal species now admitted would have been referred to their proper rank. There seems to be no reason why *Hesperomys leucopus* may not range as widely as *Jaculus hudsonius*, and but little to show that such is not the case.

62. **Arvicola Gapperi** VIGORS. RED-BACKED MOUSE. Apparently not very rare in some localities in the eastern part of the State. Professor Baird mentions seven specimens sent him by Mr. J. W. P. Jenks from Middleboro'.\* There are also several specimens in the Museum of Comparative Zoölogy from localities near Cambridge. It has not yet been met with, however, in the vicinity of Springfield. It is apparently less southern in its distribution than the next following species.

63. **Arvicola riparius** ORD. COMMON MEADOW MOUSE. Abundant; periodically excessively so. At such times they often do great harm by destroying fruit and other trees. Apple-trees a foot in diameter are sometimes killed by being girdled by these destructive animals. They also occasionally destroy large numbers of those of smaller size, as well as of young pitch-pines (*Pinus rigida* Linn.) and other native trees. Their excessive increase is generally coincident with a series of winters during which the ground is covered with a heavy deposit of snow, which protects them from cold, and beneath which they burrow and commit their ravages. Their decrease generally occurs during a series of "open" winters, when in searching for their food they are wholly unprotected from severe cold, and the deep freezing of the ground obstructs their shallow burrows, within which they are doubtless often frozen. They frequent every variety of situa-

\* N. Am. Mam., p. 521.

tion, from half-submerged meadows to the driest sandy plains. Dr. Godman, in his *American Natural History*,\* under *Arvicola xanthognathus*, has very minutely described the habits of this species. While in meadows it forms roadways among the roots of the grass on the surface, in grain-fields it burrows beneath the surface, its habits varying with circumstances. In the latter situation the vegetation is not generally sufficiently dense to screen it, hence its more subterranean mode of life. Their nests are found containing newly born young from early in May till November. The number of litters produced by a single female in a year is probably generally not less than three, and may be more; the young of the early litters also themselves appear to have young the same season; hence the great rapidity of increase that obtains in this species.

Specimens, even from the same locality, vary considerably in size, color, the texture of the fur, and even in the shape of the skull, independently of considerable variations that result from age and season. On these variations have been erected numerous nominal species, some of which are already currently considered as synonyms of *A. riparius* Ord, and several more, doubtless, should be added to the list. Among those described from or attributed to Massachusetts which I refer to *A. riparius* are *A. hirsutus* and *A. albo-rufescens* Emmons,† *A. nasuta* Audubon and Bachman,‡ and *A. Breweri* and *A. rufidorsum* Baird;§ also, *A. rufescens* De Kay,|| from New York.

On Muskeget Island (a small, uninhabited, low sandy island between Nantucket and Martha's Vineyard) I recently found the so-called *A. Breweri* excessively abundant. This is the only locality from which this supposed species has been reported. They are generally much paler in color than the *A. riparius* of the interior, and though not differing from them appreciably in any other respects, they form an interesting insular race. From the peculiar character of the locality, the scattered beach-grass growing upon it affording but slight protection to these animals from the sunlight, the intensity of which is greatly heightened by the almost bare, light-colored sands, the generally bleached appearance of the Muskeget *Arvicola* might have been anticipated. Specimens occasionally occur of nearly the ordinary color, or which are undistinguishable from the lighter-colored speci-

\* Vol. II, p. 66.

† Report on Quad. of Mass., p. 60.

‡ Journ. Phil. Acad. Nat. Sci., Vol. VIII, p. 296; Quad. N. Am., Vol. III, p. 211, Pl. 144, Fig. 2.

§ N. Am. Mam., pp. 525, 526.

|| N. Y. Fauna, Vol. I, p. 85, pl. XXII, Fig. 1.



mens from the interior; but most of them seem to be quite like the ones described by Professor Baird. The mice living on the extensive sand-dunes at Ipswich, under circumstances similar to those of the Muskeget mice, often present, as I have recently ascertained, the half-white appearance of the *A. "Breweri."*

The *A. albo-rufescens*, described by Dr. Emmons from two nearly white or cream-colored specimens procured at Williamstown, is, as first suggested by Audubon, undoubtedly but an albinic variety of *A. riparius*. Having obtained two specimens at Springfield that almost exactly accorded with Emmons's description of *A. albo-rufescens*, I was led at first to consider it a valid species. Subsequent experience convinced me that this is not its character. Two similarly colored specimens of the woodchuck (*Arctomys monax*), unquestionably albinic, have been since obtained at Springfield, which differ from the ordinary condition of that animal in the same way that these specimens of *Arvicola* do from the ordinary state of *A. riparius*. Audubon and Bachman mention similar examples that came under their notice; in one case different stages of albinism were observed in the different individuals of the same litter. A short time since I myself received an interesting albinic example of this species from Weathersfield, Vermont, from my friend Mr. J. P. Stoughton, of which the following is a description: Beneath, except the extreme posterior part of the body, pure white; mainly white above, with a wide, rather irregular band of dusky along the back; the anterior part of the head and the cheeks dusky; posterior part of the head white, with several dusky spots; ears, thighs, and a large spot on the left shoulder, dusky, with small axillary spots of the same color; all the feet and the terminal third of the tail, white. Irides a little lighter than the natural color, but not red. Ears conspicuous; much longer than the short, soft fur. A little smaller, and rather slenderer than ordinary specimens. Apparently a mature female, taken August 18, 1868. Albinos of this species appear to be not infrequent, the capture of a litter in which all the individuals greatly resembled the parti-colored one above described having come to my knowledge since the above was written.

The single specimen from Holmes's Hole, described as *A. rufidorsum*,\* which is thus far the only recognized specimen of this supposed species extant, seems to be but an unusually highly colored example of *A. riparius*. At Springfield, where I have examined hundreds of specimens at different seasons of the year, the variation in color is very considerable, ranging from decidedly gray on the one extreme to as decidedly rufous chestnut-brown on the other. They are usually much grayer in March and April than they are late in the fall.

\* See N. Am. Mam., p. 526, as previously cited.



The following is a partial list of the synonymes of

**Arvicola riparius.**

- Arvicola riparius* ORD, Journ. Phil. Acad. Nat. Sci., IV, 1825, 305.  
 " " DEKAY, N. Y. Fauna, Pt. I, 1842, 84, Pl. XXII, Fig. 2.  
 (Young.)  
 " " AUD. and BACH., Quad. N. Am., III, 1854, 302.  
 " " KENNICOTT, Pat. Off. Rep., 1856, Agr., 1857, 304.  
 " " BAIRD, N. Am. Mam., 1857, 522.  
 " *palustris* HARLAN, Faun. Am., 1825, 126.  
 " *albo-rufescens* EMMONS, Quad. Mass., 1840.  
 " " DEKAY, N. Y. Fauna, 1842, I, 89.  
 " *hirsutus* EMMONS, Quad. Mass., 1840, 60.  
 " " DEKAY, N. Y. Fauna, I, 86.  
 " *oneida* Ibid., 88, Pl. XXIV, Fig. 1.  
 " *rufescens* Ibid., 85, Pl. XXII, Fig. 1.  
 " *nasuta* AUD. and BACH., Journ. Phil. Acad. Nat. Sc., VIII (2), 1842, 296.  
 " " Ibid., North Am. Quad., III, 1853, 211, Pl. CLXIV, Fig. 2.  
 " *pennsylvanica* AUD. and BACH., Quad. N. Am., I, 1849, Pl. XLV, 341.  
 " *rufidorsum* BAIRD, Mam. N. Am., 1857, 526.  
 " *Breweri* Ibid., 525.  
 " *xanthognathus* \* GODMAN, Am. Nat. Hist., II, 1826, 65.  
 " " DEKAY, N. Y. Fauna, I, 1842, 90.  
 " " LINSLEY, Am. Jour. Sc., XLIII, 1842, 350.

64. **Arvicola pinetorum** AUD. & BACH. (*A. [Pitymys] pinetorum* Baird.) The only specimens of this species I have seen from this State are one captured at Springfield in May, 1868, by my brother, Mr. E. Allen, and one taken by myself a few weeks later. Both were taken in the same field on the "pine plains" east of the city. Audubon and Bachman, I find, speak of having received it from near Boston, from Dr. Brewer. These authors also speak of it as occurring in Connecticut, and as abundant in certain portions of Rhode Island.† Professor Baird cites it from Long Island,‡ whence Audubon and Bachman derived their first specimens of *A. "scalopsoides,"*§ which they afterwards very properly considered as a synonyme of *A. pinetorum*. It

\* Whatever the "*A. xanthognathus*" of Leach and Richardson (Faun. Bor. Am., I, 122) may have been, the *A. xanthognathus* of Godman, DeKay, and Linsley unquestionably refers to the *A. riparius* of Ord.

† Quad. N. Am., II, p. 216.

‡ Mam. N. Am., p. 544.

§ Journ. Phil. Acad. Nat. Sci., VIII, p. 299.

being a southern species, Massachusetts is probably its northern limit. Its occurrence here is comparatively rare.

65. **Fiber zibethicus** Cuv. MUSKRAT. Abundant. Individuals nearly black are taken occasionally.

### HYSTRICIDÆ.

66. **Erethizon dorsatus** F. Cuv. (*E. dorsatus* and *E. epixanthus* Auct.) PORCUPINE. "HEDGEHOG." Occasional on the Hoosac ranges.

Professor Baird, in his description of this species,\* thus observes: "Fur, dark brown; the long projecting bristly hairs dusky, with white tips; spines white, the points dusky. Nasal bones not more than one third the length of the upper surface of the skull." He adds: "I regret not to have a sufficiently perfect specimen of the common Eastern porcupine before me to furnish a satisfactory description. The differences, however, from *E. epixanthus*† are not very great, consisting chiefly in the color of the tips of the long hairs, and one description will answer very well for both, except where the peculiarities of each are specially indicated. The range of this species is much more limited than previously supposed, as it is replaced west of the Missouri by the *E. epixanthus*."

He thus describes *E. epixanthus*, from several good specimens: "General color dark brown, nearly black; the long hairs of the body tipped with greenish-yellow. Nasal bones nearly one half or two fifths the length of the upper surface of the skull"; which he says are not more than one third in *E. dorsatus*. Nine very fine specimens of *E. dorsatus* in the Museum of Comparative Zoölogy, from Central Maine, show that the color of the projecting bristly hairs is variable. In one they are *entirely black*, except a very few about the head, which are tipped with lighter; in another those of the back are black, while on the head, sides of the shoulders, etc., they are tipped with dull yellowish-white. Several have them of the greenish-yellow supposed to characterize exclusively *E. epixanthus*; in one or two only can they be called white, while in one these bristly hairs are almost entirely absent, being quite so on the back. The quills usually project considerably beyond the fur, but are sometimes quite concealed within it. Their color varies from white to dull yellow. Professor

\* Mam. N. Am., p. 569.

† "*E. epixanthus* Brandt, Mém. Acad. de St. Petersburg, 1835. 388, 416; Plate I (animal) and Plate IX. Figs. 1-4, skull."

Baird's detailed description of the exterior characters of *E. epixanthus* is in every respect applicable to fully one half the specimens from Maine referred to above, while none differ essentially from it. The differences referred to by him in the relative length of the nasals in the two supposed species are relatively very slight, especially as compared with the large amount of variability presented in a large series of the skulls of *Arctomys monax*, or of our common squirrels or rabbits; the difference in the proportional length of the nasals to the whole length of the skull, in five specimens of *E. epixanthus* and three of *E. dorsatus*, as given by Professor Baird, being but 4 per cent; the nasals in *E. dorsatus* being 37 per cent of the whole length of the skull, and in *E. epixanthus* 41. In No. 676 (*E. "dorsatus"*) of Baird's table, the proportional length of the nasals to the entire skull is 39 per cent; in No. 3066, 32 per cent. In No. 822 (*E. "epixanthus"*), 39 per cent. In other words, the specimen in the series of *E. dorsatus* in which the nasals are longest differs less than one-third of one per cent in the proportional length of the nasals to the whole skull from the specimen with relatively the shortest nasals in the series of the *E. epixanthus* specimens.

I am not able at this time to refer to M. Brandt's paper, but Waterhouse, in his Natural History of the Mammalia,\* refers to it as follows: "Five specimens of an *Erethizon* from the West Coast of North America, in the Museum of St. Petersburg, having the exposed ends of the longest hairs of the fur of a brownish-yellow color instead of white, as the same hairs are stated to be in the *E. dorsatus*, M. Brandt is inclined to suppose there are two species of *Erethizon*, but not having specimens of the Canada animal for comparison, he is not able to satisfy himself upon this point. The specimens examined by M. Brandt are from California and Unalaska, and I may add that a similar specimen is found at Sitka, as I remember to have seen a specimen in the Leyden Museum from there agreeing with M. Brandt's description; its *spines* [not *hairs*] were most of them of a delicate yellow below the dark point." The following is Mr. Waterhouse's description of *E. epixanthus*, compiled from M. Brandt's memoir: "The longer and coarser hairs brownish-yellow at the point; spines white or yellowish at the base, and most of them brownish-black or dusky at the apex."

It hence appears that the three principal writers on the subject — Brandt, Waterhouse, and Baird — have neither of them had specimens of the two species for comparison at the time of writing; Brandt having only his five West Coast specimens, Waterhouse compiling from Brandt, and Baird's specimens coming, two from the Republican Fork, one from New Mexico, and one from California, with three or four skulls from the East.

Dr. Brandt must have been much influenced by the difference in locality whence his specimens came, in supposing there might be two species of *Erethizon*, since the only difference he points out — that of the color of the tips of the long hairs — is one of a trivial, and, as all mammalogists must be aware, most inconstant character. The differences in the skulls discovered by Professor Baird, though so appreciable, have less weight since we know that skulls of individuals of the same species from the *same locality* not unfrequently vary as much, and in the same way. Again, according to the measurements he has given, and which are discussed above, one specimen of the one series of three is not appreciably different from a specimen of the other series of five. Hence, though having only Eastern specimens for examination, I quite confidently refer, for the reasons given above, the *E. epixanthus* Brandt to the *E. dorsatus* F. Cuvier. I am quite sure, also, that, had either Professor Baird or Dr. Brandt possessed a good series of *E. dorsatus* from Eastern North America, they could hardly have admitted the latter's doubtfully proposed species, even provisionally.

Prince Maximilian, in speaking of the porcupines of the Upper Missouri,\* mentions them simply under the generic name *Erethizon*, stating that he was unable to decide whether the animal he observed should be referred to *E. dorsatus* or to *E. epixanthus*.

Dr. J. E. Gray, in the proceedings of the London Zoölogical Society,† has described a small specimen of *Erethizon* from Columbia as a new species, under the name of *E. (Echinoprocta) rufescens*, although there is nothing to indicate that it is in any way different from the young of the common *E. dorsatus*. The differences on which he has raised it to a distinct section or subgenus are only such as characterize the young or half-grown animal in *E. dorsatus*, with which also his corresponds in size.

## LEPORIDÆ.

67. **Lepus americanus** ERXL. (Emmons's Rep., p. 56.) WHITE RABBIT. Common, but generally less so than the next. Rare in the immediate vicinity of Springfield, though numerous at localities less than ten miles distant, in several directions.

68. **Sylvilagus nanus** GRAY.‡ (*Lepus sylvaticus* BACH. *Lepus*

\* Wiegmann's Archiv, XVIII, Theil I, p. 150.

† 1865, 121, Pl. XI; also in the Annals and Magazine of Natural History of the same year.

‡ In a recent paper entitled "Notes on the Skulls of Hares (*Leporidae*) and Picas (*Lagomysidae*) in the British Museum," Dr. J. E. Gray has given names to the sections of the old genus *Lepus*, first indicated by Professor Baird in his well-studied essay on this group (N. Am. Mam., pp. 572-620), and raised them to the rank of genera, thereby, of

*virginianus* Harlan, Emm. Rep., p. 58.) GRAY RABBIT. Abundant in most parts of the State. Less common in the more elevated portions, and quite unknown in the higher ranges of the western counties.

# GENERAL SYNOPSIS AND REMARKS ON THE GEOGRAPHICAL DISTRIBUTION OF THE SPECIES.

## I. *Indigenous Species still existing in the State.*

- |  |  |
|--|--|
| 1. <i>Lynx canadensis Raf.*</i>          | 26. ? <i>Balanoptera rostrata</i> .        |
| 2. " <i>rufus Raf.*</i>                  | 27. <i>Physeter macrocephalus Pander.*</i> |
| 3. <i>Canis lupus Linn.*</i>             | 28. <i>Mesoplodon sowerbiensis.*</i>       |
| 4. <i>Vulpes vulgaris Cuv.</i>           | 29. <i>Oreca gladiator Sund.</i>           |
| 5. " <i>virginianus DeKay.*</i>          | 30. <i>Globiocephalus melas Traill.</i>    |
| 6. <i>Mustela Pennantii Erxl.*</i>       | 31. <i>Hyperaodon bidens Owen.*</i>        |
| 7. " <i>martes Linn.*</i>                | 32. <i>Beluga canadensis Erxl.*</i>        |
| 8. <i>Putorius vulgaris Linn.</i>        | 33. <i>Lagenorhynchus sp.?</i>             |
| 9. " <i>ermineus Linn.</i>               | 34. <i>Delphinus erebennus Cope.</i>       |
| 10. " <i>lutreolus Cuv.</i>              | 35. " <i>clymene Gray.*</i>                |
| 11. <i>Gulo luscus Sabine.*</i>          | 36. <i>Phocæna americana Agass.</i>        |
| 12. <i>Lutra canadensis Sab.</i>         | 37. <i>Lasiurus noveboracensis Tomes.</i>  |
| 13. <i>Mephitis mephitica Baird.</i>     | 38. " <i>cinereus H. Allen.*</i>           |
| 14. <i>Procyon lotor Storr.</i>          | 39. <i>Scotophilus fuscus H. Allen.</i>    |
| 15. <i>Ursus arctos Linn.*</i>           | 40. " <i>noctivagans H. Allen.</i>         |
| 16. <i>Phoca vitulina Linn.</i>          | 41. " <i>georgianus H. Allen.</i>          |
| 17. <i>Cystophora cristata Nilsson.</i>  | 42. <i>Vespertilio subulatus Say.</i>      |
| 18. <i>Cariacus virginianus Gray.*</i>   | 43. <i>Neosorex palustris Verrill.*</i>    |
| 19. <i>Balæna eisæretica Cope.</i>       | 44. <i>Sorex platyrhinus Linsley.</i>      |
| 20. <i>Agaphalus gibbosus Cope.</i>      | 45. <i>Sorex Cooperi Bach.*</i>            |
| 21. <i>Megaptera osphyia Cope.</i>       | 46. " <i>Forsteri Rich.*</i>               |
| 22. <i>Eschrichtus robustus Lilj.*</i>   | 47. <i>Blarina brevicauda Baird.</i>       |
| 23. <i>Sibbaldius tectirostris Cope.</i> | 48. <i>Scalops aquaticus Fisch.</i>        |
| 24. " <i>tuberosus Cope.*</i>            | 49. " <i>Breweri Bach.*</i>                |
| 25. " <i>borealis Fisch.*</i>            | 50. <i>Condylura cristata Ill.</i>         |

course, introducing numerous changes in nomenclature. *Lepus* is restricted to the larger species, typically represented by *L. americanus* Erxl. and the European *L. timidus* Linn. Thirty species of the old genus *Lepus* are enumerated, but a considerable proportion appear to rest on highly questionable grounds. Dr. Gray enumerates in this paper thirty-nine species of *Leporidae* alone, of which sixteen are North American and two South American. The characters of these groups, so far at least as they relate to the North American species, are those developed by Professor Baird in his excellent elaboration of this family.

\* Species marked with the asterisk are very sparsely represented; among the Carnivora most of those thus distinguished have become nearly exterminated.

- |                                     |   |
|-------------------------------------|---|
| 51. <i>Sciurus cinereus</i> Linn.*  | 59. <i>Hesperomys leucopus</i> LeConte. |
| 52. " <i>carolinensis</i> Gmelin.   | 60. <i>Arvicola Gapperi</i> Vigors.     |
| 53. " <i>hudsonius</i> Pall.        | 61. " <i>riparius</i> Ord.              |
| 54. <i>Pteromys volucella</i> Linn. | 62. " <i>pinetorum</i> LeConte.*        |
| 55. <i>Tamias striatus</i> Baird.   | 63. <i>Erethizon dorsatus</i> F. Cuv.*  |
| 56. <i>Arctomys monax</i> Gmelin.   | 64. <i>Lepus americanus</i> Erxl.       |
| 57. <i>Fiber zibethicus</i> F. Cuv. | 65. <i>Sylvilagus sylvaticus</i> Gray.  |
| 58. <i>Jaculus hudsonius</i> Baird. |   |

## II. *Extirpated Species.*

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. <i>Felis concolor</i> Linn.    | 4. <i>Cervus canadensis</i> Linn. |
| 2. <i>Alce malchis</i> Ogl.       | 5. <i>Castor fiber</i> Linn.      |
| 3. <i>Tarandus rangifer</i> Gray. |                                   |

## III. *Adventitious Species.*

- |                               |
|-------------------------------|
| 1. <i>Mus decumanus</i> Linn. |
| 3. " <i>rattus</i> Linn.      |
| 3. " <i>musculus</i> Linn.    |

## IV. *Northern Species.*

[Not occurring in this State south of the Canadian fauna (excepting *Lepus americanus*, which ranges through the Alleghanian), and hence represented only in portions of the western counties.]†

- |                               |                                |
|-------------------------------|--------------------------------|
| 1. <i>Mustela Pennantii</i> . | 5. <i>Tarandus rangifer</i> .  |
| 2. " <i>martes</i> .          | 6. <i>Arvicola Gapperi</i> .   |
| 3. <i>Gulo luscus</i> .       | 7. <i>Erethizon dorsatus</i> . |
| 4. <i>Alce malchis</i> .      | 8. <i>Lepus americanus</i> .   |

## V. *Southern Species.*

[Not occurring north of the Alleghanian Fauna, and hence unrepresented in the more elevated parts of the State, though more or less common in the other portions.]

† *Antea*, in a foot-note to page 147, *Cervus canadensis* is included among the species there mentioned as characteristic of the Canadian fauna, as formerly represented in Massachusetts. I have since found, from what is known of its earlier range, that it probably once extended over the greater part of the States lying east of the Mississippi, and undoubtedly extended along the Atlantic coast farther south even than Southern New England. There is unquestionable evidences of its existence within the last fifty years on both sides of the Ohio River near its mouth; a locality much more southern, faunally as well as geographically, than any part of New England. Hence it cannot be taken as a species the southern boundary of whose habitat marks the lower limit of the Canadian fauna, as there stated.



- |                                |                                   |
|--------------------------------|-----------------------------------|
| 1. <i>Vulpes virginianus</i> . | 5. <i>Sciurus carolinensis</i> .  |
| 2. <i>Scalops aquaticus</i> .  | 6. <i>Arvicola pinetorum</i> .    |
| 3. " <i>Breweri</i> .          | 7. <i>Sylvilagus sylvaticus</i> . |
| 4. <i>Sciurus cinereus</i> .   |                                   |

VI. *Restricted to the Eastern Province.*

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| 1. <i>Cervus canadensis</i> .        | 12. <i>Sciurus cinereus</i> .      |
| 2. <i>Cariacus virginianus</i> .     | 13. " <i>carolinensis</i> .        |
| 3. ? <i>Scotophilus georgianus</i> . | 14. " <i>hudsonius</i> .           |
| 4. <i>Neosorex palustris</i> .       | 15. <i>Tamias striatus</i> .       |
| 5. <i>Sorex Cooperi</i> .            | 16. ? <i>Arctomys monax</i> .      |
| 6. " <i>Forsteri</i> .               | 17. ? <i>Hesperomys leucopus</i> . |
| 7. " <i>platyrhinus</i> .            | 18. <i>Arvicola Gapperi</i> .      |
| 8. <i>Blarina brevicauda</i> .       | 19. " <i>riparius</i> .            |
| 9. <i>Scalops aquaticus</i> .        | 20. " <i>pinetorum</i> .           |
| 10. " <i>Breweri</i> .               | 21. <i>Lepus americanus</i> .      |
| 11. <i>Condylura cristata</i> .      | 22. <i>Sylvilagus sylvaticus</i> . |

VII. *Species restricted to America, but which range over the greater portion of the Northern Continent.\**

- |                                   |                                      |
|-----------------------------------|--------------------------------------|
| 1. <i>Felis concolor</i> .        | 9. <i>Scotophilus fuscus</i> .       |
| 2. <i>Lynx canadensis</i> .       | 10. " <i>noctivagans</i> .           |
| 3. " <i>rufus</i> .               | 11. <i>Lasiurus noveboracensis</i> . |
| 4. <i>Vulpes virginianus</i> .    | 12. " <i>cinereus</i> .              |
| 5. <i>Mustela Pennantii</i> .     | 13. <i>Pteromys volucella</i> .      |
| 6. <i>Mephitis mephitis</i> .     | 14. <i>Fiber zibethicus</i> .        |
| 7. <i>Procyon lotor</i> .         | 15. <i>Jaculus hudsonius</i> .       |
| 8. <i>Vespertilio subulatus</i> . | 16. <i>Erethizon dorsatus</i> .      |

VIII. *Species that occur throughout the colder portion of the Northern Hemisphere.*

(Cetacea not included.)

- |                              |                                  |
|------------------------------|----------------------------------|
| 1. <i>Canis lupus</i> .      | 8. <i>Ursus arctos</i> .         |
| 2. <i>Vulpes vulgaris</i> .  | 9. <i>Phoca vitulina</i> .       |
| 3. <i>Mustela martes</i> .   | 10. <i>Cystophora cristata</i> . |
| 4. <i>Putorius erminea</i> . | 11. <i>Alce malchis</i> .        |
| 5. " <i>vulgaris</i> .       | 12. <i>Tarandus rangifer</i> .   |
| 6. " <i>lutreolus</i> .      | 13. <i>Castor fiber</i> .        |
| 7. <i>Gulo luscus</i> .      |                                  |

\* Probably *Sciurus hudsonius* and *Hesperomys leucopus* should be transferred from the preceding list to this.

IX. *Comparative Table.*

Showing what species of Dr. Emmons's Report on the Quadrupeds of Massachusetts, Dr. DeKay's on the Mammalia of the State of New York, and Mr. J. P. Linsley's Catalogue of the Mammals of Connecticut, are synonymous with those of the present list.

NOTE. — The numbers refer to the same species in each column. Domesticated and fossil species and the Cetacea are omitted.

| <i>Present List.</i>   | <i>Emmons's Report.</i> | <i>Linsley's Catalogue.</i> | <i>DeKay's Report.</i>  |
|------------------------|-------------------------|-----------------------------|-------------------------|
| 1. Felis concolor.     | 1. Felis concolor.      | 1. Felis concolor.          | 1. Felis concolor.      |
| 2. Lynx canadensis.    | 2. Lynxus borealis.     | 2. Lynxus borealis.         | 2. Lynxus borealis.     |
| 3. " rufus.            | 3. " rufus.             | 3. " rufus.                 | 3. " rufus.             |
| 4. Canis lupus.        | 4. Canis lupus.         | 4. Canis lupus.             | 4. Canis lupus.         |
| 5. Vulpes vulgus.      | 5. Vulpes fulvus.       | 5. Vulpes fulvus.           | 5. Vulpes fulvus.       |
| 6. " virginianus.      | 6. Vulpes virginianus.  | 6. " cinereo-argentatus.    | 6. " virginianus.       |
| 7. Mustela pennanti.   | 7. Mustela canadensis.  | 7. Mustela canadensis.      | 7. Mustela canadensis.  |
| 8. " martes.           | 8. " martes.            | 8. " martes.                | 8. " martes.            |
| 9. Putorius vulgaris.  | 9. Putorius vulgaris.   | 9. " pusilla.               | 9. " pusilla.           |
| 10. " ermineus.        | 10. " noveboracensis.   | 10. " fusca.                | 10. " fusca.            |
| 11. " lutreolus.       | 11. " vison.            | 11. " vison.                | 11. " vison.            |
| 12. Gulo luscus.       | 12. ———                 | 12. ———                     | 12. Gulo luscus.        |
| 13. Lutra canadensis.  | 13. Lutra canadensis.   | 13. Lutra canadensis.       | 13. Lutra canadensis.   |
| 14. Mephitis mephitis. | 14. Mephitis americana. | 14. Mephitis americana.     | 14. Mephitis americana. |
| 15. Procyon lotor.     | 15. Procyon lotor.      | 15. Procyon lotor.          | 15. Procyon lotor.      |
| 16. Ursus arctos.      | 16. Ursus americanus.   | 16. Ursus americanus.       | 16. Ursus americanus.   |

| <i>Present List.</i>         | <i>Emmons's Report.</i>         | <i>Linsley's Catalogue.</i>     | <i>DeKay's Report.</i>          |
|------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 17. Alce malehis.            | 17. Cervus alces.               | 17. ———                         | 17. Cervus alces.               |
| 18. Tarandus rangifer.       | 18. " tarandus.                 | 18. ———                         | 18. Rangifer tarandus.          |
| 19. Cervus canadensis.       | 19. ———                         | 19. ———                         | 19. Elaphus canadensis.         |
| 20. Cariacus virginianus.    | 20. " virginianus.              | 20. Cervus virginianus.         | 20. Cervus virginianus.         |
| 21. Phoca vitulina.          | 21. ———                         | 21. { Phoca concolor.           | 21. Phoca concolor.             |
| 22. Cystophora cristata.     | 22. ———                         | 22. Stenmatopus eristatus.      | 22. Stenmatopus eristatus.      |
| 23. Lasiurus noveboracensis. | 23. Vespertilio noveboracensis. | 23. Vespertilio noveboracensis. | 23. Vespertilio noveboracensis. |
| 24. " cinereus.              | 24. " prinosus.                 | 24. " prinosus.                 | 24. " prinosus.                 |
| 25. Scotophilus fuscus.      | 25. " carolinensis.             | 25. " carolinensis.             | 25. " carolinensis.             |
| 26. " georgianus.            | 26. ———                         | 26. ———                         | 26. ———                         |
| 27. " noctivagans.           | 27. ———                         | 27. " noctivagans.              | 27. " noctivagans.              |
| 28. Vespertilio subulatus.   | 28. ———                         | 28. " subulatus.                | 28. " subulatus.                |
| 29. Neosorex palustris.      | 29. ———                         | 29. ———                         | 29. ———                         |
| 30. Sorex platyrhinus.       | 30. ———                         | 30. Sorex platyrhinus.          | 30. Osorex platyrhinus.         |
| 31. " Forsteri.              | 31. ———                         | 31. ———                         | 31. Sorex Forsteri.             |
| 32. " Cooperi.               | 32. ———                         | 32. ———                         | 32. ———                         |
| 33. Blarina brevicauda.      | 33. ———                         | { Sorex brevicauda.             | { Sorex brevicauda.             |
|                              |                                 | { " parvus.                     | { " parvus.                     |
|                              |                                 | { " DeKayi.                     | { " DeKayi.                     |
|                              |                                 |                                 | { " carolinensis.               |
| 34. Scalops aquaticus.       | 34. Scalops canadensis.         | 34. Scalops canadensis.         | 34. Scalops aquaticus.          |
| 35. " Breweri.               | 35. ———                         | 35. ———                         | 35. ———                         |
| 36. Condylura cristata.      | 36. { Condylura longicaudata.   | 36. { Condylura longicaudata.   | 36. Condylura cristata.         |
|                              | { " macroura.                   | { " macroura.                   |                                 |
| 37. Sciurus cinereus.        | 37. Sciurus vulpinus.           | 37. Sciurus vulpinus.           | 37. Sciurus vulpinus.           |

|                                   |                                   |  |                                  |
|-----------------------------------|-----------------------------------|--|----------------------------------|
| 38. <i>Sciurus carolinensis</i> . | 38. { <i>Sciurus leucotis</i> .   | 38. { <i>Sciurus carolinensis</i> .    | 38. { <i>Sciurus leucotis</i> .  |
| 39. " hudsonius.                  | 39. " niger.                      | 39. " hudsonius.                       | 39. " niger.                     |
| 40. <i>Pteromys volucella</i> .   | 40. { <i>Pteromys volucella</i> . | 40. { " — ?                            | 40. <i>Pteromys volucella</i> .  |
| 41. <i>Tamias striatus</i> .      | 41. <i>Sciurus striatus</i> .     | 41. <i>Sciurus striatus</i> .          | 41. <i>Sciurus striatus</i> .    |
| 42. <i>Arctomys monax</i> .       | 42. <i>Arctomys monax</i> .       | 42. <i>Arctomys monax</i> .            | 42. <i>Arctomys monax</i> .      |
| 43. <i>Castor fiber</i> .         | 43. <i>Castor fiber</i> .         | 43. <i>Castor fiber</i> .              | 43. <i>Castor fiber</i> .        |
| 44. <i>Fiber zibethicus</i> .     | 44. <i>Fiber zibethicus</i> .     | 44. <i>Fiber zibethicus</i> .          | 44. <i>Fiber zibethicus</i> .    |
| 45. <i>Jaculus hudsonius</i> .    | 45. <i>Gerbillus canadensis</i> . | 45. <i>Gerbillus canadensis</i> .      | 45. <i>Meriones americanus</i> . |
| 46. <i>Mus decumanus</i> .        | 46. <i>Mus decumanus</i> .        | 46. <i>Mus decumanus</i> .             | 46. <i>Mus decumanus</i> .       |
| 47. " <i>rattus</i> .             | 47. { " <i>rattus</i> .           | 47. { <i>Arvicola albo-rufescens</i> . | 47. { <i>Mus rattus</i> .        |
| 48. " <i>musculus</i> .           | 48. " <i>musculus</i> .           | 48. <i>Mus musculus</i> .              | 48. " <i>americanus</i> .        |
| 49. <i>Hesperomys leucopus</i> .  | 49. <i>Arvicola Emmonsii</i> .    | 49. " <i>agrarius</i> .                | 49. " <i>musculus</i> .          |
| 50. <i>Arvicola Gapperi</i> .     | 50. — — —                         | 50. — — —                              | 50. " <i>leucopus</i> .          |
| 51. " <i>riparius</i> .           | 51. { <i>Arvicola hirsutus</i> .  | 51. { <i>Arvicola riparius</i> .       | 51. { <i>Arvicola riparius</i> . |
| 52. " <i>pictorum</i> .           | 52. — — —                         | 52. — — —                              | 52. { " <i>rufescens</i> .       |
| 53. <i>Erethizon dorsatus</i> .   | 53. <i>Hystrix dorsata</i> .      | 53. <i>Hystrix dorsata</i> .           | 53. " <i>hirsutus</i> .          |
| 54. <i>Lepus americanus</i> .     | 54. <i>Lepus americanus</i> .     | 54. <i>Lepus americanus</i> .          | 54. " <i>oneida</i> .            |
| 55. <i>Sylvilagus sylvaticus</i>  | 55. " <i>virginianus</i> .        | 55. " <i>virginianus</i> .             | 55. " <i>albo-rufescens</i> .    |
| — — —                             | — — —                             | — — —                                  | 52. ? " <i>zanthognathus</i> .   |
|                                   |                                   |  | 53. <i>Hystrix hudsonica</i> .   |
|                                   |                                   |  | 54. <i>Lepus americanus</i> .    |
|                                   |                                   |  | 55. " <i>nanus</i> .             |
|                                   |                                   |  | — <i>Didelphys virginiana</i> .  |

X. *General Summary.*

|   |     |
|---|-----|
| Number of indigenous species still living in the State . . . . .    | *65 |
| “ species already extirpated . . . . .                              | 5   |
| “ adventitious species . . . . .                                    | 3—  |
| Whole number . . . . .  | 73  |
| Number of land species (including the seals) . . . . .              | 52  |
| “ marine species (the cetaceans) . . . . .                          | 18  |
| “ northern species † . . . . .                                      | 7   |
| “ southern species † . . . . .                                      | 8   |
| “ species restricted to the region east of the great sterile plains | 22  |
| “ “ that range over the greater part of the continent               | 15  |
| “ “ common to North America and the North Old World                 | 13  |
| “ “ that are numerous represented                                   | 28  |
| “ “ that are sparsely represented . . . . .                         | 45  |
| “ “ of Felidæ (including 1 extirpated) . . . . .                    | 3   |
| “ “ Canidæ . . . . .  | 3   |
| “ “ Mustelidæ . . . . .   | 8   |
| “ “ Ursidæ . . . . .  | 2   |
| “ “ Phocidæ . . . . .   | 2   |
| “ “ Cervidæ (including 3 extirpated) . . . . .                      | 4   |
| “ “ Balænidæ . . . . .  | 8   |
| “ “ Physeteridæ . . . . .   | 2   |
| “ “ Delphinidæ . . . . .  | 8   |
| “ “ Vespertilionidæ . . . . .                                       | 6   |
| “ “ Soricidæ . . . . .  | 5   |
| “ “ Talpidæ . . . . .   | 3   |
| “ “ Sciuridæ (including 1 extirpated) . . . . .                     | 7   |
| “ “ Muridæ (including 3 adventitious) . . . . .                     | 9   |
| “ “ Hystriidæ . . . . .   | 1   |
| “ “ Leporidæ . . . . .  | 2   |
| “ “ Carnivora (5 families) . . . . .                                | 18  |
| “ “ Ruminantia (1 family) . . . . .                                 | 4   |
| “ “ Cetacea (3 families) . . . . .                                  | 8   |
| “ “ Insectivora (3 families) . . . . .                              | 14  |
| “ “ Rodentia (4 families) . . . . .                                 | 19  |
| Number of families represented . . . . .                            | 16  |

Less than one half of the indigenous species existing in the State, as indicated above in Table I, are common, and more than a third are

\* Emmons gave 41; Linsley, for Connecticut, 52; DeKay, for New York, 60.

† See notes to Tables IV and V, *ante*, p. 239.

rare. The common ones, with a few exceptions (*Putorius lutreolus*, *P. ermineus*, and *Mephitis mephitis* among the carnivores, *Vespertilio subulatus* and *Lasiurus noveboracensis* among the bats), belong to the three families of rodents, — the squirrels (*Sciuridæ*), the mice (*Muridæ*), and the hares (*Leporidæ*), — and to the *Balenidæ* and *Delphinidæ*, which latter are, of course, marine. In species and families, the carnivores and rodents are about equally represented, but in individuals any one of the more common rodents outnumbers all the carnivores together. Probably a single species of *Arvicola* (*A. riparius*) alone outnumbers, when it is most abundant, all the other mammals.

The list of Extirpated Species, forming Table II, five in number, is composed entirely of such animals as, from their large size and being special objects of the chase, would be expected to earliest disappear. Two of the four species of *Cervidæ* (*Alce malchis*, *Tarandus rangifer*) have not existed in the southern half of New England since the discovery of the continent by Europeans, except in the mountains of Western Massachusetts, and there probably only as occasional migrants from the contiguous region north. They may have existed in comparatively recent times in portions of the Alleghanies, but respecting such existence we have no certain record. At a remote period they must have lived much farther south than they do now, or than they have within the last three centuries, since bones of the Caribou have been found by Professor Wyman in the Kjoekkenmøddings of Southern Maine, and teeth that he believes, but does not positively assert, belong to this species in those of Cape Cod. A positive evidence of the former much greater southward extension of the habitat of this animal is indeed already at hand, a small antler and fragments of others of the Caribou being included in the very large collection of the remains of living and extinct species of mammalia recently brought by Professor N. S. Shaler to the Museum of Comparative Zoölogy from Big Bone Lick, Kentucky.\* Remains of the elk and the moose having been found in the shell-mounds of the Atlantic coast as far south as New Jersey, we have evidence that these species existed thus far south in comparatively recent times.

To the list of the "extirpated species," nine† that are now ex-

\* See Professor Shaler's remarks concerning these specimens in Proc. Bost. Soc. Nat. Hist., Vol. XIII, 1869.

† *Lynx canadensis*, *L. rufus*, *Canis lupus*, *Mustela Pennantii*, *M. martes*, *Gulo luscus*, *Ursus arctos*, *Cariacus virginianus*, *Erethizon dorsatus*.



tremely rare, some of them probably being but casual visitors from Vermont or New York, must soon be added. The fisher and the wolverine may be even now extinct, and the common deer exists in the wild state only by legal protection.

The three adventitious species (see Table III), which are the most noxious of our mammalia, are intruders that, like many of the common weeds, have accompanied civilized man in his voyages till they are almost cosmopolitan in their distribution.

Table IV, composed of northern species, consists, with one exception (*Arvicola Gapperi*), also of species of large size, and such as are special objects of the chase, either for their fur or for food. They hence early disappear before the advance of civilization, and it is now almost impossible to determine in respect to some of them where was formerly their natural southern limit of distribution. At present none of them (*Lepus americanus* excepted) range below the southern boundary of the Canadian fauna, though some may have formerly extended across the next fauna south. The occurrence of *Mustela martes* and *M. Pennanti* in the Alleghanies, the latter as far south as Buncomb County, North Carolina, is well established,\* but they seem to be, or to have been, — they being now apparently nearly exterminated there, — confined to the mountains, and hence also to the Canadian fauna. Yet one or both of them have occurred in a few known instances at points rather more southern, faunally, than their usual range, but apparently only during casual migrations in winter.

The *Erethizon dorsatus*, however, seems to have formerly occurred at points clearly within the Alleghanian fauna, as in Western New York,† Northern Ohio,‡ Northern Indiana, Southern Michigan, and Southern Wisconsin;§ but it has disappeared in all the more thickly settled parts of the United States; east of the Mississippi it does not now occur south of the Canadian fauna.

The *Lepus americanus*, also chiefly northern in its distribution, ranges, as before stated, a little farther south than the others, and finds its southern limit near the southern boundary of the Alleghanian fauna.

\* Audubon and Bachman, Quad. N. Am., Vol. I, p. 314.

† Dr. J. E. DeKay, N. Y. Fauna, Vol. I, p. 79.

‡ Wm. Case, Esq., in Audubon and Bachman's Quad. N. Am., Vol. I, p. 285.

§ R. Kennicott, Pat. Off. Rep., Agr., 1857, p. 91; I. A. Lapham, Transact. Wisc. State Agr. Soc., 1852, p. 340.

Table V, comprising those species that do not occur north of the Alleghanian fauna, embraces but one of relatively large size, — *Vulpes virginianus*, — which is also the only carnivore; the others are two moles and four rodents. The presence of the species of this list, and the absence of those of the preceding, form the faunal differences that, among mammals, distinguish the Alleghanian from the Canadian fauna. The other thirty-three species of land mammals represented in the fauna of Massachusetts, and which are common to the other New England States, New York, the northern tier of the States westward to the Mississippi, and the greater portion of the Canadas, range widely both to the north and to the south, and some of them also to the westward, extending throughout the colder parts of the northern hemisphere, as is indicated by Tables VII and VIII.\*

\* In this connection a word in reference to the nature of faunæ may not be out of place, since naturalists of some eminence, but who cannot have thoroughly investigated the subject, appear to think that no faunal districts are recognizable unless there is an entire or almost an entire change in the species represented, while some altogether discard such distinctions. Such an extensive change more properly characterizes the larger divisions in geographical zoology, as the provinces and realms, rather than faunæ. It rarely happens that any species is restricted within the limits of a single fauna, and also rarely within those of two. There is not a single well-known species of mammal or bird but inhabits (taking the breeding range only of the latter) an area embracing two or more faunæ, and but few that do not range over more than two. The greater part extend over three, and a large proportion have a still wider distribution, as shown by Tables VII and VIII (see remarks respecting these beyond). But in going north or south from any point within the temperate zones, one observes at certain intervals (generally of about six or seven degrees of mean annual temperature) a marked change in the species, through the disappearance of some and the appearance of others; this change giving rise to well-marked differences in the general facies of the fauna at points not far distant. The habitats of species being in the main nearly coincident in their northern and southern boundaries with isothermal lines, and not with parallels of latitude; and since a number of species usually disappear at nearly the point at which a number of others first make their appearance, the limits of faunæ are thus readily defined, at least approximately. As isotherms necessarily vary with every inequality in the surface of the country, they rarely correspond, as is well known, with the parallels of latitude; and plants and animals sharing the same apparent irregularity in their distribution, some naturalists have been led to discredit the existence of recognizable zoological and botanical districts, or of any definite system in the distribution of animals and plants.

Faunæ, then (the term *fauna* in its restricted sense being usually and properly employed to designate the smallest zoologico-geographical district), it may be added, are characterized by the peculiar association of species. Generally about twenty-five per cent of those embraced in either of two adjacent faunæ are absent from the other. Rarely do adjoining faunæ differ essentially in genera, though necessarily more or less occasionally. The absence or presence of genera, sub-families, families, and even sometimes orders, more properly characterizes the higher sub-divisions, as provinces and realms.

Each of the twenty-one species mentioned in the next table (Table VI) has a comparatively restricted range, the western limit of their habitats being in most cases the eastern border of the sterile plains of the middle province. This list is composed principally of shrews, moles, and rodents; none of the first two groups and but a few of the latter ranging across the continent. The absence of carnivores from this list is its most striking feature.

Table VII embraces fifteen species that, while restricted to America, range from the Atlantic to the Pacific, and possess a correspondingly wide distribution in latitude, most of them occurring nearly throughout the northern continent. This list is composed almost exclusively of carnivores and bats, all but one of the Massachusetts species of the latter having been found in California, and at various intermediate points.

Table VIII contains thirteen species that are regarded in this paper as common to the Old World and the New; ten of these are carnivores, and include all the New England species of that group, except those embraced in the preceding list. The geographical distribution of these species, and of the groups to which they belong, affords further evidence in favor of the supposition of the specific identity of their representatives on the two continents above assumed; each species ranging as far north on both as it seems possible for mammalian life to exist. Each has also an extended distribution southward, on each continent, some of them ranging nearly or quite to the tropics; which shows them to be fitted to exist under widely varying physical conditions. These conditions in the northern portions of their respective habitats differ much more from those of the southern portions than those of localities on the two continents ordinarily do when situated under the same isotherm. The representatives of the species in question from the eastern and western continents differ less, as has been previously stated, when the specimens compared are taken from those portions nearly contiguous, as Northwestern America and Northeastern Asia, than when they come from such widely distant points as Eastern North America and Western Europe, the nearest affinity being between those from the localities first mentioned, and the widest differences between those from the latter. The eastern and western continents, moreover, approach each other so nearly at Behring's Straits, that several of the species in question are able to pass occasionally from one to

the other. It hence seems unnecessary to suppose the former existence of an Atlantic continent to explain their present distribution. It is also a noteworthy fact that no cases of close affinity among the mammals inhabiting these two continents occur in species that do not range very far to the northward, as in the *Felidæ*, for example, where the only case at all suggestive of identity, or even of close relationship, occurs between the *Lynx canadensis* of Northern North America and the *Lynx lynx* of Northern Europe; both of which species range the farthest north of any of their family, and reach the Arctic regions.

All the circumpolar species, the beaver alone excepted, pertain to the most highly organized groups found in the colder portion of the northern hemisphere, and to which belong not only all the widely ranging species of the north temperate and boreal regions, but those of this character everywhere. With three exceptions, all are carnivores. Two of the others are ruminants, and one is a rodent.

The species most highly organized in their respective families, orders, or classes are almost universally those that possess the widest geographical distribution; partial exceptions occur only in groups where the means of locomotion is specialized, or unusually developed, as in the bats among mammals. The shrews, moles, and rodents, which comprise about three fifths of the species of the North American mammals, are groups of low structural rank, and abound in species of comparatively local distribution. In this great number there are but five or six, allowing the broadest latitude in respect to the limitation of the species, that at all approach to a continental distribution, and only three as the species are usually restricted.\* This is about two one-hundredths of one per cent. Only one can be regarded as identical with any Old World species. In the canivores, on the other hand, excluding sub-tropical and nominal species, the number of those that range over most of the continent reaches nearly seventy-five per cent, while fifty per cent. or one half, are identical with Old World species. In the ruminants, which rank below the carnivores, but far above the rodents and insectivores, the species having a similarly wide range on this continent, number not far from thirty per cent. Several of them are identical with Old World species. The bats, though a low group, are,

\* *Castor fiber*, *Fiber zibethicus*, and *Jaculus hudsonius*. Probably the following may be added to the list of those that range across the continent: *Erethizon dorsatus*, *Sciurus hudsonius*, *Pteromys volucella*, *Hesperomys leucopus*.

from their special means of locomotion, able to range widely; but to their allies, the moles and shrews, mountain chains and arid plains prove impassable barriers.

The same laws in respect to the character of the species that among mammals have a wide distribution are equally exemplified in birds, all the wide-ranging species being of high rank, or such members of lower groups as have the power of flight unusually developed. The modification of the anterior limbs into organs of flight specially characterizing the class of birds among vertebrates, it is evident that well-developed wings are one of the elements essential to a high grade of structure; and this renders necessary the coincidence in this class of high rank with a wide geographical range. The few land-birds that embrace a large portion of the two northern continents within their respective habitats belong principally to three families. — the finches, and the hawks and owls. The first is one of the highest, if not the highest, family of the class, and the others are by no means low. The other species which have a circumpolar distribution are among the highest members of their respective families, and are rarely of a low grade. The finches thus distributed all belong to the highest genera of their family. Among the birds having a wide distribution, but which are restricted to a single continent, are the typical thrushes, another of the higher groups. The species of the short-winged genera of the Fringillidæ and Turdidæ, on the other hand, are almost invariably the most circumscribed in their habitats.\* This coincidence in respect to structure and distribution is also exemplified in every sub-family, as well as family, among the water-birds; but it is not necessary to trace it further here.

Hence the view above taken in reference to the species claimed to be common to the Old World and the New is supported, not only by the

\* Compare the species of *Turdus* with those of *Harporhynchus* and *Mimus*; of *Pooecetes* and *Passerculus* (see observations on some of the supposed species of *Passerculus* in Mem. Bost. Soc. Nat. Hist., Vol. I, p. 515) with those of *Melospiza*, *Coturniculus*, and *Ammodramus*; or those of the sub-family *Coccothraustinae* with those of the sub-family *Spizellinae*. Compare, also, in the *Sylviolidae*, the species of *Dendæon* with those of *Geothlypis*. Also note the very high rank of the species of *Egiothus*, *Pinicola*, and *Plectrophanes*, and the wide extent of their habitats. Compare further, in *Falconide*, the species of *Falconinae*, with their long pointed wings and compact firmly knit muscular bodies, giving unequalled powers of flight, and their extensive habitats, in several instances embracing a whole hemisphere, with the comparatively short-winged, sluggish, and clumsy species of *Buteoninae*, of a much lower type of structure and much narrower range.



evidence already given in the special discussion of each case, but by the fact of the near approximation of their habitats, and by general principles.

The thirteen species of land mammalia common to North America and the Old World embraced in the fauna of Massachusetts comprise all thus distributed now known, except two or three very boreal ones. The faunæ of the two continents are really quite different,—not totally so, as has been claimed,—though represented largely by genera and families common to the two. These and the circumpolar species show that a close relationship exists between them, the resemblance being, in fact, far greater than between the faunæ of Southern Mexico and Canada. The difference between the faunæ of the subtropical and cold temperate zones on either continent is many times greater than between the faunæ of the temperate and boreal regions of North America and the same regions of the Old World.\*

But four species have been attributed to the States adjoining Massa-

\* The distribution of vegetable life in zones, differing from each other in general character and corresponding in their limitation with climatic or isothermal zones, and their similar succession at different altitudes on mountain slopes and in different latitudes at the ordinary level of the land, was partially very early recognized, but first fully demonstrated only half a century ago, by Baron Alexander von Humboldt. It was somewhat later before it was clearly shown that the same law holds in respect to the distribution of terrestrial animal life, which was done in 1845 by Professor Louis Agassiz,<sup>1</sup> and somewhat later still Professor Dana disclosed its presence in the distribution of marine life, in his admirable essay on the geographical distribution of the crustacea.<sup>2</sup> Yet most recent writers who have given attention to the geographical distribution of animals appear to have overlooked this grand fact, and hence have been led to adopt a highly artificial division of the earth's surface in respect to its primary ontological regions. While geographical botanists have so generally recognized the influence of climate, and especially of temperature, in determining the limits of distribution of plants in latitude and in altitude, zoölogists, with only a few exceptions, have very imperfectly appreciated these important influences upon the distribution of animals. While the relation of the present distribution of life to the existing means of communication between the different bodies of land and to the earlier conditions in this respect are of the highest importance in investigations of this kind, if this is the only element taken into account, as is sometimes the case, climatic influences being for the time over-

<sup>1</sup> "Note sur la Distribution Géographique des Animaux et de l'Homme." Bulletin de la Société des Sciences Naturelles de Neuchâtel, Tom. I, 1845. See also, by the same author, a paper on the "Geographical Distribution of Animals," in the Edinburgh New Philosophical Journal, Vol. XLVI, 1850, pp. 1-25. Also his "Sketch of the Natural Provinces of the Animal World and their Relation to the different Types of Man," in Nott and Gliddon's Types of Mankind, 1854, p. lviii.

<sup>2</sup> U. S. Expl. Exped. Reports, Crustacea, Vol. II, 1852, pp. 1451-1500.



chusetts that have not been detected in the latter. Two of them — *Didelphys virginiana* Shaw, and *Lepus glacialis* Leach, the former occurring in Southern New York, and the other attributed to Northern Maine, and known to occur in Newfoundland \* — are not likely to occur here. The other two, *Sorex Thompsonii* Baird † and *Blarina angusticeps* Baird. ‡ — the latter described from a specimen taken at Burlington, Vermont, and the other reported from the same locality, from Halifax, N. S., and Maine, § — are of a highly questionable character. What has been called *Sorex Thompsonii* (the young probably of either *S. Forsteri* or *S. Cooperi*) doubtless occurs here.

looked, the argument is one-sided, only half the truth is reached, and the general view is a distorted one.<sup>1</sup>

As I have already remarked above, the mutual resemblance between the faunæ and floræ of the boreal portions of North America and those of the Europeo-Asiatic continent is exceedingly great, amounting in the arctic portion, as was long since pointed out,<sup>2</sup> almost to identity. In the Arctic province, which occupies the woodless tracts in the extreme north of both continents, more than four fifths of the species found on the one continent occur on the other. While a few of the small number that inhabit this region are restricted to it, the larger part range much farther to the southward, the majority even over the colder part of the north temperate zone, and several throughout this zone. Besides the mutual floral and faunal resemblance between the two northern continents imparted by this wide distribution of the circumpolar species, this resemblance is increased by the large number of genera that are circumpolar, besides those that embrace the circumpolar species, and the occurrence of other forms, both specific and generic, that are closely allied. It is also true that among the forms restricted to each continent are a few family groups; yet the number of these, as of species and genera, that occur in the tropical and not in the colder temperate regions on either continent is far greater than that of those peculiar to either of the two northern continents. Consequently to apply as ontologico-geographic designations such terms as "Palæogean Creation" to the Eastern world and "Neogean Creation" to the Western, virtually implies the ignoring of the real close affinity of the life of the whole northern hemisphere at the northward, and the vast difference between that of the tropical and the cooler north temperate regions on the same continent. But a further discussion of this point is uncalled for now, and is, moreover, the more out of place here, since I shall, I trust, soon have an opportunity to treat it in detail in a more legitimate connection.

\* Quad. N. Am., Vol. I, p. 248.

† N. Am. Mam., p. 34.

‡ Ibid., p. 47.

§ Proc. Bost. Soc. Nat. Hist., Vol. IX, p. 169.

<sup>1</sup> See Murray's Geog. Distrib. of Mammals; Wallace's Malay Archipelago, etc.

<sup>2</sup> See Agassiz's papers, cited above.